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VIEWS, NEWS AND INTERVIEWS.

W. H. Fitzgerald, the manager of the Detroit Electric Light Company, charged with bribery, was discharged by Judge Sheahan, of Detroit, last week. The court made this decision on the ground that the charge of bribing Alderman Protiva was not supported by sufficient evidence.

Inventors and experimenters will have an opportunity this week of trying their electrical devices to propel boats along the Erie canal. Should any of these prove successful, it may revolutionize the mode of propulsion on our inland waterway. It is more than probable that within the next two years the much-despised mule will tread the tow-path of glory no more.

It is reported that the cash receipts of the Westinghouse Electric Company for April were the largest in the history of the company.

The price of private telephones in London is to be reduced from £20 a year to £10 a year, subject to the condition of a five-years contract.

An exceedingly quick reading electrical thermometer has recently been brought out in France. It is intended for clinical work, and will record variations in temperature of one-twentieth of a degree centigrade.

The armature of a dynamo which was being tested at the Westinghouse works in Allegheny, burst last week, injured two men and did other damage. It was a 250 horse-power machine, and burst just as the power was about to be turned off. Frederick Klages was struck in the back by a small piece of metal, but was not badly hurt. Another man had his left arm injured. Some windows were broken and other damage done to the building.

The Connecticut legislature has passed a law providing that no electric, cable or horse railway shall hereafter be constructed to cross tracks of a steam railroad at grade, and *vice versa*, unless by special authority of the railroad commissioners.

Certainly one of the most important electrical plants in existence, says *Invention*, is that now employed by the Aluminum Industrial Company, of Neuhausen, Switzerland, which is actuated by water power from the falls of the Rhine. Here four dynamos of 150 horse-power each, one of 300 horse-power and two of 600 horse-power have been recently erected. Additions to this plant will comprise four generators, designed to give 7,500 amperes at 55 volts pressure, at 150 revolutions per minute. The number of dynamos is yet to be extended to an aggregate capacity of 3,900 horse-power. These machines are equipped with huge commutators and sets of 120 brushes. There is but one man in charge of three or four dynamos, the throttle of the turbines and the brushes of the dynamos being handled from one point.

A new tree insulator has been introduced which greatly simplifies the problem of attaching wires to trees so that they may in no way come in contact with the branches. The insulator proper is on a shaft which

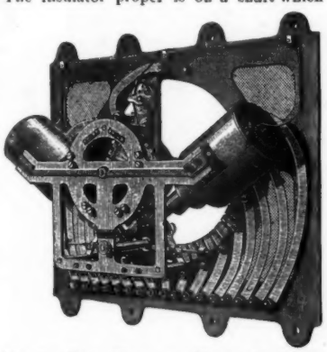


FIG. 1.—REAR VIEW OF TRUMPY'S AUTOMATIC REGULATOR FOR ACCUMULATORS.

works in a ball and socket joint, the cup of which is made fast to the tree. It matters not how much the tree may be swayed by the wind, for the line is kept by this means

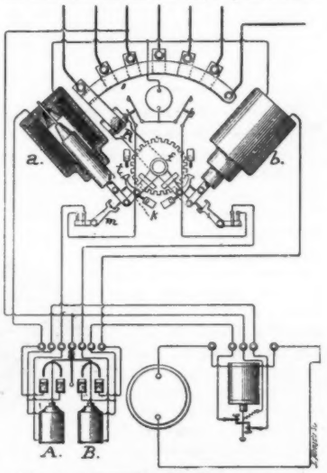


FIG. 2.—DIAGRAM OF A REGULATOR.—BACK VIEW.

in its normal position, and is thus effectually prevented from coming in contact with any part of the tree and grounding the circuit.

An excellent testimony to the merit of the new system of consuming the refuse of a city's streets is reported from Madras, where a new electric railway plant is about to be put into operation. There will be three or four small power stations, and at each of these the boiler furnaces will be built on the destructor principle, with the idea of using the street rubbish as fuel. It is expected that about 600 cart-loads a day will be consumed, and thus clean streets and cheap electric light and power will be secured at the same time.

Washington Electrical Dealers Unite.

The leading electrical firms of Washington, D. C., have recently formed an association for establishing a more general and better understanding and unanimity among themselves, and for their mutual benefits. The association was organized last July and is known as the "Association of Electrical Dealers and Contractors." The officers for the ensuing year are: President, C. W. Jordan; vice-president, J. W. Burkett; secretary, C. W. Messner; treasurer, John R. Galloway. The firms represented are Messrs. Jordan & McLeod, J. W. Burkett & Company, Royce & Marean, the Washington Construction Company (Pardoe & Messner), the Bliss Engineering Company (Bliss & Lewis), John R. Galloway, D. H. Washburn and J. H. Kueling. The association is in a flourishing condition and has already shown to its members that it is a valuable aid to electrical interests in Washington.

The New York Central's Fast Train.

The new "Exposition Flyer," recently put on by the New York Central and Hudson River Railroad, to run between New York and Chicago, has proven an instant success. Berths are engaged several days in advance, and the train has been filled every day since it was put on.

The hours are particularly well arranged for the New York business man who desires to do a day's work in New York and have the entire business day following for business in Chicago. The train leaves here at 3 P. M., after the day's business is practically over, and arrives in Chicago at 10 A. M. the

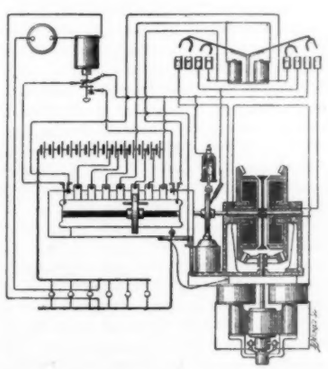


FIG. 3.—DIAGRAM OF A LARGE TRUMPY REGULATOR FOR AN ELECTRIC MOTOR.

next day, in time for a full day's work in the World's Fair city. This enterprise of the New York Central virtually reduces the time between New York and Chicago to one night's ride, and the business world cannot fail to greatly appreciate it and to be benefited by it.

Trumpy's Automatic Regulator for Accumulators.

A new regulating device has recently been installed at the electric light station in Berne, Switzerland, and is said to do excellent work. It is the invention of M. Trumpy.

A reliable, automatic regulator for secondary batteries has long been sought for by managers of electric light stations. As the apparatus is already in several hundred stations, we believe that the readers of the ELECTRICAL REVIEW will be glad to know the construction of this device and its underlying principles.

It is manufactured in two sizes, and for a current varying from 50 to 2,000 amperes, with 6 or 36 contact bars respectively. Of course, parts of each machine are interchangeable; among others the relay which operates with any given current. In the smaller model the contacts, as well as the contact makers and breakers, are placed upon a non-conducting base, generally of slate, while the motor is fastened to a cast iron frame.

The smaller model, the so-called "simple automatic regulator," is generally preferred for private electric light installations. The regulating device performs all the necessary operations by means of a relay and switch, which are upon a wooden panel together with the necessary binding post, so that the engineer has only to make comparatively few connections, and then rest assured that no trouble can come to the apparatus. The larger model may also be used in small electric light stations, but in that case fewer parts are required; it occupies but little more space than the small model.

Brushes, pressing upon the main switch, are connected to a specially constructed voltmeter, enabling the person in charge of the station to see at a glance the potential of the charged cells, and preventing their being injured by an excessive current. Another switch maintains a constant voltage in the electric light circuit, and is so constructed that it acts automatically, while the charging lever or switch is set by hand. Thus there is no interruption of the current and no short circuits in the accumulators.

Fig. 1 represent the automatic regulator used at Berne for 16 cells, giving 225 amperes. As will be seen, the entire device is accessible, so that it can easily be cleaned, and the various contact points examined; moreover, all movable parts of the apparatus can be inspected during actual operation.

Figs. 2 and 3 are diagrams of the regulator. The line or charging circuit is connected to the relay. If the voltage is too low, the core of the relay descends, establishing an electric connection with the lower contact stop. On the other hand, should the voltage become too great, the core ascends thereby closing the upper contact. This alternate closing of one or the other circuit energizes one of the two small electro-magnets of the switch (marked A—B Fig. 2),

which thereupon establishes a circuit through one of the main switch regulating electro-magnets. As soon as coil *a* has become energized it draws in its core. This movement, by means of lever K, causes detent *t*, to turn *f*, thus moving the main switch, R. Any motion of the core corresponds to a predetermined motion of R, by which an additional cell is cut in or out. Whenever the core of the relay is between the two contact stops the current through the two small and main electro-magnets is interrupted.

It is stated that this regulator acts very rapidly, corresponding to very slight changes of current. Again, as the mechanical portion of the regulator is very simple, it demands little attention or care. In the larger model (see Fig. 3) the electro-magnets are replaced by a motor which transmits its motion by some simple intermediate mechanism to the main switch lever. In systems employing three or five conductors, a single motor is sufficient.

The Fort Wayne Electric Company at the World's Fair.

The Fort Wayne Electric Company have completed their exhibit in Electricity Building, and have made a most noteworthy display. Their exhibit is located in the southwestern portion of the building, on the ground floor, and consists of machinery placed as follows:

In the extreme left hand corner appears a small historical exhibit, consisting of an ironclad dynamo built by James J. Wood, way back in 1879. This machine, although 14 years old, can compare favorably with machines of to-day. Scientific visitors and electricians are requested to examine this model. Immediately to the right of this model appears the new 75 kilowatt slow-speed alternator, lately designed by James J. Wood. The armature is ironclad, thoroughly ventilated and practically indestructible. The bearings are of the expansion type, self-oiling, and proportioned to stand an enormous overload without the use of unnecessary material. The machine is compound wound, responding without a spark to any variations in load.

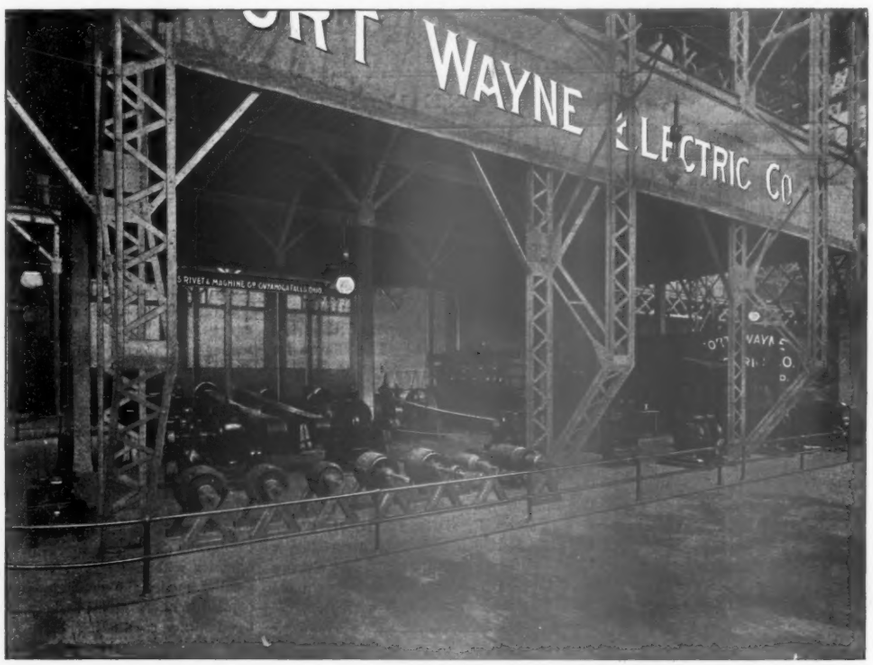
Next to this is a Slattery 1,200 lighter of the compound type, which machine is very reliable, but is not expected to hold its own against the new Wood machine. A Wood 40 light machine finishes out the row of machines in actual operation on this side of the line shaft. The object of this 40 lighter is to demonstrate by reading instruments placed in the motor circuit that the Wood arc machine is absolutely automatic. For this purpose they have erected a lamp rack on which are hung 84 arc lamps, 40 of which are for demonstrating the regulation, and the other 44 are composed of the different alternating and low tension lamps which the company is building for the regular market. They have also a 120 arc light machine, an 80 light machine and as small as one light machine on the floor for visitors to examine and compare with other makes of dynamos.

On the other side of the shaft will be found two Wood incandescent dynamos which furnish 400 and 250 lights, at 110 volts respectively; two Wood motors, one of 120 and the other of 80 horse-power, which operates the shaft which runs the entire plant. The shaft was made by the Falls Rivet Machine Company, of Cuyahoga Falls, Ohio, expressly for this work, and it is certainly a model of transmission machinery. All the pulleys are fitted with clutches, enabling them to be started or turned off at will. The shaft is in two sections, enabling a relief of motors and power to be effected at any time it is found necessary.

The switchboards, which are three in number, are as follows: One motor and incandescent switchboard, having instruments, starting box, rheostats, switches, etc., for the two motors and the incandescent dynamos. The distributing switchboard, having a capacity of 12 machines and 12 circuits, is utilized for the distribution of 110 volt current throughout the building, either alternating or direct, as the user may require. The arc switchboard, which is also the switchboard for the alternating machines, comprises features not found in any other switchboard. In making this exhibit they have tried to carry out the idea of showing a modern central station run by power transmitted from a distance. They also have different kinds of machines and current in operation, all of which are driven from one generator, from their exhibit space in Machinery Hall, where may also be found a large number of Wood machines used for contract lighting.

They are running in the building, at the present, 96 arc lights, and the equivalent of 100 horse power in motors and incandescent lights, which makes their exhibit useful as well as ornamental.

Attached to this space is the office, handsomely furnished and equipped with furniture, where their friends and patrons are at all times welcome.



THE EXHIBIT OF THE FORT WAYNE ELECTRIC COMPANY AT THE WORLD'S FAIR.

Launches in China.

Reports from the Consuls of the United States for May, 1893, have been received. Consul Fowler, of Ningpo, China, in his report on "Steam and Electric Launches in China," in an account of an interview with the Taotai of his district, says, "It must be remembered that this vast district is intersected by thousands of miles of canals and rivers; and although it covers a territory of 39,500 square miles, and has a population of ffom 25,000,000 to 35,000,000 people, there is not a single launch or boat of any kind propelled by steam, oil, or electricity, excepting a few launches that ply from Shanghai to Hangchow, the capital, 150 miles northeast from this port." Further on he says, "I have been discussing the benefits of small launches with the Taotai for the past two years, and now he has requested me to find out all I can for him. If he should adopt a launch for his own use, I am quite confident that it will not be long before many orders will be placed with our manufacturers. There is a splendid opening here. An immense traffic is carried on in boats, which now depends on the tide and the endurance of the 'yu loese' (scullers). A company has been organized at Swatow, of Chinese, who run a steam ferry (launches) a short distance up river, and I understand they are doing a very lucrative business."

Evidently the value of influence is appreciated in China as well as in this country, and it seems that it is but necessary for the general introduction of electric launches, to "prevail" upon the Taotai, or some other official high in power, to use one for his personal comfort and satisfaction, and thus this gentleman taking the initiative will have his example followed by the many who look up to him as a person above the ordinary.

The Course of Electrical Engineering at Johns Hopkins University.

The Johns Hopkins University Register for 1892-93 has been received. It contains succinct accounts of the many valuable courses to be obtained in that institution. That which attracts our especial notice is the description of the special two years' course in electrical engineering. In most institutions of this kind the course in this subject, generally of four years' duration, is identical with that of mechanical engineering for the first two years, the latter two being devoted exclusively to the theory and practice of electricity. However, in this course the prospective student is permitted to join the classes, provided he has a knowledge of both differential and integral calculus, and that he has studied physics and chemistry and either French or German. It is intended for graduates, but special students are admitted after having satisfactorily passed the required examinations.

Instruction is given by Dr. Louis Duncan, associate professor of electricity; Mr. Hermann S. Hering, M. E., associate in electrical engineering; and Mr. Francis Head, M. E., instructor in mechanical engineering.

Many other facilities and opportunities offered make the Johns Hopkins course in electrical engineering a most valuable and thorough one.

Electric Heating and Its Applications.

In the wonderful developments and applications of electricity during the past decade the subjects of light and power have received the most attention, and more has been done in these branches than in any other to make them commercially successful and applicable to the daily needs of humanity.

The great question of heat, one of the most important elements of life, while not by any means overlooked, has still, so far as the application of electricity to this end is concerned, remained more or less dormant up to the present time. The matter, while the subject of deep thought and many experiments by our inventors, has long baffled their best efforts, and while from time to time more or less has been accomplished, the practical and economical conversion of electrical energy into heat has but recently been proved to be entirely feasible.

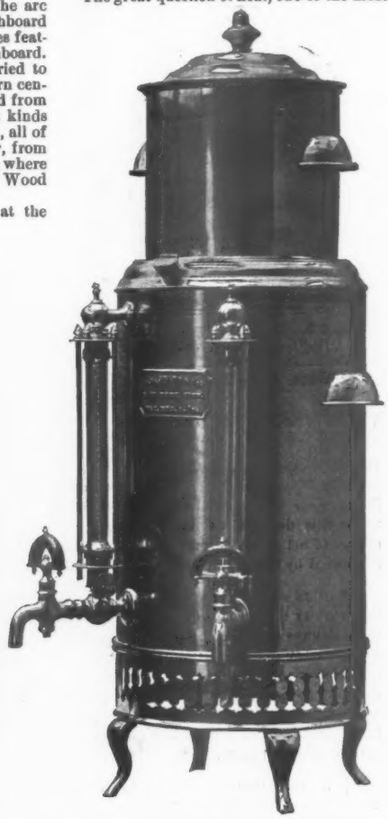


FIG. 1.—ELECTRIC HEATING AND ITS APPLICATIONS.—COFFEE AND TEA URN.

It has remained for the American Electric Heating Corporation, of Boston, a concern composed of a number of influential business men, who have fully realized the immense possibilities of the field they are about to open up, to bring the matter prominently before the public, and demonstrate in the strongest possible terms the perfect utility of electric heating, and the many advantages it offers, not only in commercial, but in domestic life.

FIG. 2.—ELECTRIC HEATING AND ITS APPLICATIONS.—PLATE STOVE.

As a practical illustration of the latter, and also to give them an idea of what had been already accomplished in the former, the representatives of the electrical press, in response to an invitation from President Edward Jewell, met in the offices of the company in this city a few days ago, and were treated to a decided novelty in the shape of a dinner, every course of which had been cooked entirely by electricity. Fish was fried, steak broiled, beef roasted, pota-

toes boiled, bread baked and coffee prepared while they waited, and entirely without the usual discomforts of heat and smoke attendant on the preparations of a dinner in the ordinary way. The results of this manner of cooking were also delicious, a sweetness and flavor being retained in the meats which is impossible over a coal fire.

After doing full justice to the "electrical dinner," the guests were escorted through the building and afforded an opportunity of inspecting some of the many novelties which will be handled by the firm. I send for illustration a few of the devices, which will give

FIG. 5.—COIL HEATER.

a faint idea of what is being done, although it is impossible to do full justice to the many ingenious contrivances displayed. Suffice it to say that for domestic use, coal, with its attendant discomforts, can be entirely discarded, and a house can be heated, lighted and all the cooking done from the same current at a reasonable cost.

For commercial uses there is nothing in which heat is a requisite which cannot be handled to better advantages by the use of the electric current, and a number of special tools were shown of very ingenious device. Among these were jewelers' outfits, crucibles, muffles, tailors' machine irons, soldering irons, glue pots, etc. As an instance of the intensity of the heat which can be generated, a stone crucible cup was melted up within a few minutes after the current was turned on.

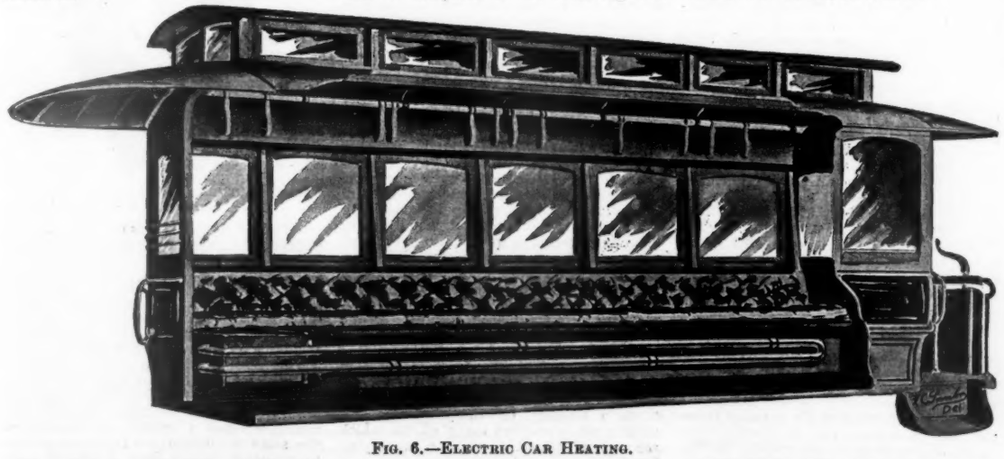


FIG. 6.—ELECTRIC CAR HEATING.

The company is said to control all the patents in the field of electric heating, among them the system of car heating which was so successfully demonstrated on the cars of the West End Company during the past severe winter.

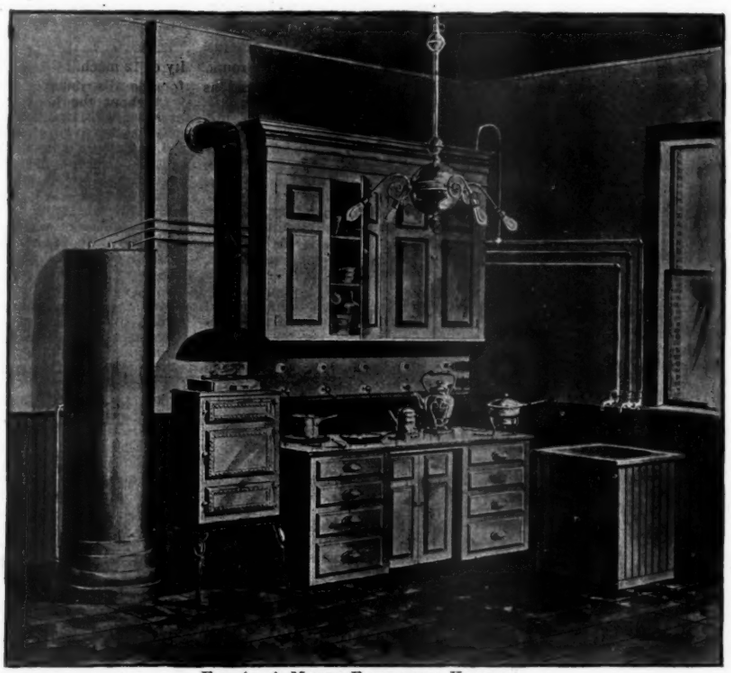


FIG. 4.—A MODEL ELECTRICAL KITCHEN.

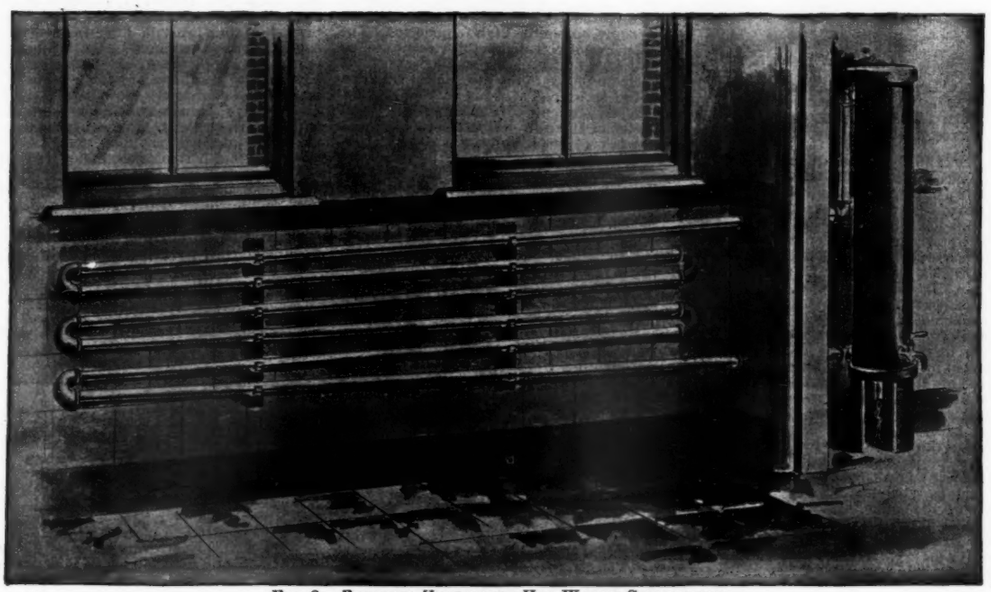


FIG. 3.—ELECTRIC HEATING BY HOT WATER CIRCULATION.

The American Electric Heating Corporation is composed of the following well known men: President, Edward Jewell; treasurer, Arthur B. Smith; directors, A. M. Dodge, New York; H. C. Duell, Syracuse, N. Y.; Ambrose Eastman, Boston, Mass.; Frederick D. Hagar, St. Paul, Minn.; Edward Jewell, Boston, Mass.; A. B. Smith, Cliftondale, Mass.; Charles Odell, Salem, Mass.; J. F. Tames, New York.

The general offices of the company are at No. 274 Purchase street, Boston, and they are represented in New York by the Central Electric Heating Company, of No. 26 Cortlandt street, and in Boston by the New England Electric Heating Company, of No. 629 Atlantic avenue. They have a capital of $5,000,000, and are in every way fitted to handle successfully what will undoubtedly prove one of the greatest enterprises of the age. The field which opens out before them is of unlimited extent, particularly as it appeals to the domestic life of the people as well as the commercial interests, and with such concerns as this behind the various branches of the industry, we may confidently predict that electricity is destined to become the heating, lighting and motive power of the world.

H. G. T.

Boston, June 7.

Providence Line — Additional Train Service.

It is announced by the management of the Providence Line that, commencing on June 12, an express train will leave Providence (from steamer's wharf) connecting with steamers from New York at 6 A. M., arriving at Boston at 7.15 A. M. Returning will leave Boston at 6.30 P. M., arriving at steamer's wharf, Providence, at 7.45 P. M., connecting with steamer for New York.

The route of the Providence Line between New York and Boston, *via* Providence, combines the longest water trip with the shortest rail ride (only 42 miles), assuring full night's rest with early arrival. The steamers of this line are equal to any in the world.

On Light and Other High Frequency Phenomena.

A LECTURE DELIVERED BEFORE THE FRANKLIN INSTITUTE, AT PHILADELPHIA, FEBRUARY 24, 1893, AND BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT ST. LOUIS, MO., MARCH 1, 1893.

BY NIKOLA TESLA.

(*Continued from page 203.*)

A hollow metal pulley P (Fig. 4*a*), was fastened upon an arbor *a*, which, by suitable means, was rotated at a considerable speed. In the inside of the pulley, but disconnected from the same, was supported a thin disc h_1 (which is shown thick for the sake of clearness), of hard rubber, in which there was embedded two metal segments *s s* with metalic extensions *e e*, into which were screwed conducting terminals *t t* covered with thick tubes of hard rubber *t t*. The rubber disc *h* with its metallic segments *s s*, was finished in a lathe, and its entire surface highly polished so as to offer the smallest possible frictional resistance to the motion through a fluid. In the hollow of the pulley an insulating liquid, such as a thin oil, was poured so as to reach very nearly to the opening left in the flange *f*, which was screwed tightly on the front side of the pulley. The terminals *t t*, were connected to the opposite coatings of a battery of condensers so that the discharge occurred through the liquid. When the pulley was rotated the liquid was forced against the rim of the pulley and considerable fluid pressure resulted. In this simple way the discharge

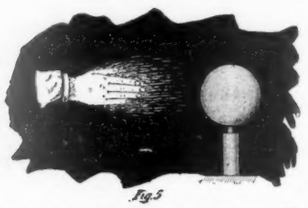


Fig. 5

TESLA LECTURE.—ILLUSTRATING THE EFFECT OF VARYING ELECTROSTATIC FORCE WITH A TRANSFORMER OF 200,000 VOLTS PRESSURE.

gap was filled with a medium which behaved practically like a solid, which possessed the quality of closing instantly upon the occurrence of the break, and which moreover was circulating through the gap at a rapid rate. Very powerful effects were produced by dischargers of this kind with liquid interrupters, of which a number of different forms were made. It was found that, as expected, a longer spark for a given length of wire was obtainable in this way than by using air as an interrupting device. Generally the speed, and, therefore, also the fluid pressure, was limited by reason of the fluid friction, in the form of discharger described, but the practically obtainable speed was more than sufficient to produce a number of breaks suitable for the circuits ordinarly used. In some instances the metal pulley P was provided with a few projections inwardly, and a definite number of breaks was then produced which could be computed from the speed of rotation of the pulley. Experiments were also carried on with liquids of different insulating power with the view of reducing the loss in the arc. When an insulating liquid is moderately warmed the loss in the arc is diminished.

A point of some importance was noted in experiments with various dischargers of this kind. It was found, for instance, that whereas the conditions maintained in these forms were favorable for the production of a great spark length, the current so obtained were not best suited to the production of light effects. Experience undoubtedly has shown that for such purposes a harmonic rise and fall of the potential is preferable. Be it that a solid is rendered incandescent, or phosphorescent, or be it that energy is transmitted by condenser coating through the glass, it is quite certain that a harmonically rising and falling potential produces less destructive action, and that the vacuum is more permanently maintained. This would be easily explained if it were ascertained that the process going on in an exhausted vessel is of an electrolytic nature.

In the diagrammatical sketch, Fig. 1, which has been already referred to, the cases which are most likely to be met with in practice are illustrated. One has at his disposal either direct or alternating currents from a supply station. It is convenient for an experimenter in an isolated laboratory to employ a machine G such as illustrated, capable of giving both kinds of currents. In such case it is also preferable to use a machine with multiple circuits, as in many experiments it is useful and convenient to have at one's disposal currents of different phases. In the sketch, D represents the direct and A the alternating circuit. In each of these, three branch circuits are shown, all of which are provided with double lines switches *s s s s s s*. Consider first the direct current conversion; 1*a* represents the simplest case. If the electromotive force of the generator is sufficient to break through a small air space, at least when the latter is warmed or otherwise rendered poorly insulating, there is no difficulty in maintaining a vibration with fair economy by judicious adjustment of the capacity, self-induction and resistance of the circuit L containing the devices *l l m*. The magnet N, S, can be in this case advantageously combined with the air space. The discharger *d d* with the magnet may be placed either way, as indicated by the full or by the dotted lines. The circuit 1*a* with the connections and devices is supposed to possess dimensions such as are suitable for the maintenance of a vibration. But usually the electromotive force on the circuit or branch 1*a* will be something like 100 volts or so, and in this case it is not sufficient to break through the gap. Many different means may be used to remedy this by raising the electromotive force across the gap. The simplest is probably to insert a large self-induction coil in series with the the circuit L. When the arc is established, as by the discharger illustrated in Fig. 2, the magnet blows the arc out the instant it is formed. Now the extra current of the break, being of high electromotive force, breaks through the gap, and a path of low resistance for the dynamo current being again provided, there is a sudden rush of the current from the dynamo upon the weakening or subsidence of the extra current. This process is repeated in rapid succession, and in this manner I have obtained oscillation with as low as 50 volts, or even less, across the gap. But conversion on this plan is not to be recommended on account of the too heavy currents through the gap and consequent heating of the electrodes; besides, the frequencies obtained in this way are low, owing to the high self-induction necessarily associated with the circuit. It is very desirable to have the electromotive force as high as possible, first, in order to increase the economy of the conversion, and, secondly, to obtain high frequencies. The difference of potential in this electric oscillation is, of course, the equivalent of the stretching force in the mechanical vibration of the spring. To obtain very rapid vibration in a circuit of some inertia a great stretching force or difference of potential is necessary. Incidentally, when the electromotive force is very great, the condenser which is usually employed in connection with the circuit need have but a small capacity, and many other advantages are gained. With a view of raising the electromotive force to a many times greater value than obtainable from ordinary distribution circuits, a rotating transformer *g* is used, as indicated in Fig. 2*a*, or else a separate high potential machine is driven by means of a motor oporated from the generator G. The latter plan is, in fact, preferable, as changes are easier made. The connections from the high tension winding are quite similar to those in branch 1*a* with the exception that a condenser C, which should be adjustable, is connected to the high tension circuit. Usually, also, an adjustable self-induction coil in series with the circuit has been employed in these experiments. When the tension of the currents is very high the magnet ordinarily used in connection with the discharger is of comparatively small value, as it is quite easy to adjust the dimensions of the circuit so that oscillation is maintained. The employment of a steady electromotive force in the high frequency conversion affords some advantages over the employment of alternating electromotive force, as the adjustments are much simpler and the action can be easier controlled. But, unfortunately, one is limited by the obtainable potential difference. The windings also break down easily in consequence of the sparks which form between the sections of the armature or commutator when a vigorous oscillation takes place. Besides, these transformers are expensive to build. It has been found by experience that it is best to follow the plan illustrated in Fig. 3*a*. In this arrangement a rotating transformer *g* is employed to convert the low tension direct currents into low frequency alternating currents, preferably also of small tension. The tension of the currents is then raised in a stationary transformer T. The secondary S of this transformer is connected to an adjustable condenser C, which discharges through the gap or discharger *d d*, placed in either of the ways indicated, through the primary P of a disruptive discharge coil, the high frequency currents being obtained from the secondary S of this coil, as described on previous occasions. This will undoubtedly be found the cheapest and most convenient way of converting direct currents.

The three branches of the circuit A represent the usual cases met in practice when alternating currents are converted. In Fig. 1*b* a condenser C, generally of large capacity, is connected to the circuit L containing the devices *l l*, *m m*. The devices *m m* are supposed to be of high self-induction so as to bring the frequency of the circuit more or less to that of the dynamo. In this instance the discharger *d d* should best have a number of makes and breaks per second equal to twice the frequency of the dynamo. If not so, then it should have at least a number equal to a multiple or even fraction of the dynamo frequency. It should be observed, referring to 1*b*, that the conversion to a high potential is also effected when the discharger *d d*, which is shown in the sketch, is omitted. But the effects which are produced by currents which rise instantly to high values, as in a disruptive discharge, are entirely different from those produced by dynamo currents which rise and fall harmonically. So, for instance, there might be in a given case a number of makes and breaks at *d d* equal to just twice the frequency of the dynamo, or, in other words, there may be the same number of fundamental oscillations as would be produced without the discharge gap, and there might even not be any quicker superimposed vibration; yet the differences of potential at the various points of the circuit, the impedence and other phenomena dependent upon the rate of change, will bear no similarity in the two cases. Thus, when working with currents discharging disruptively, the element chiefly to be considered is not the frequency, as a student might be apt to believe, but the rate of change per unit of time. With low frequencies, in a certain measure, the same effects may be obtained as with high frequencies, provided the rate of change is sufficiently great. So if a low frequency current is raised to a potential of, say, 75,000 volts and the high tension current passed through a series of high resistance lamp filaments, the importance of the rarefied gas surrounding the filament is clearly noted, as will be seen later; or, if a low frequency current of several thousand amperes is passed through a metal bar, striking phenomena of impedence are observed, just as with currents of high frequencies. But it is, of course, evident that with low frequency currents it is impossible to obtain such rates of change per unit of time as with high frequencies, hence the effects produced by the latter are much more prominent. It was deemed advisable to make the preceding remarks, inasmuch as many more recently described effects have been unwittingly identified with high frequencies. Frequency alone in reality does not mean anything, except when an undisturbed harmonic oscillation is considered.

In the branch 3*b* a similar disposition as in 1*b* is illustrated, with the difference that the currents discharging through the gap *d d* are used to induce currents in the secondary S of transformer T. In such case the second-

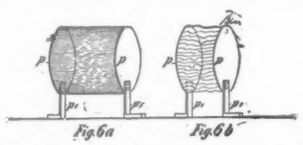


Fig. 6a Fig. 6b

TESLA LECTURE.—ILLUSTRATING THE EFFECTS OF RAPIDLY VARYING AND STEADY ELECTROSTATIC FORCE.

ary should be provided with an adjustable condenser for the purpose of tuning it to the primary.

Fig. 2*b* illustrates a plan of alternate current high frequency conversion which is most frequently used and which is found to be most convenient. This plan has been dwelt upon in detail on previous occasions and need not be described here.

Some of these results were obtained by the use of a high frequency alternator. A description of such machines will be found in my original paper before the American Institute of Electrical Engineers, and in periodicals of that period, notably in *The Electrical Engineer* of March 18, 1891.

I will now proceed with the experiments.

ON PHENOMENA PRODUCED BY ELECTROSTATIC FORCE.

The first class of effects I intend to show you are effects produced by electrostatic force. It is the force which governs the motion of the atoms, which causes them to collide and develop the life-sustaining energy of heat and light, and which causes them to aggregate in an infinite variety of ways, according to Nature's fanciful designs, and to form all these wondrous structures we perceive around us; it is, in fact, if our present views be true, the most important force for us to consider in Nature. As the term *electrostatic* might imply a steady electric condition, it should be remarked, that in these experiments the force is not constant, but varies at a rate which may be considered moderate, about one million times a second, or thereabouts. This enables me to produce many effects which are not produceable with an unvarying force.

When two conducting bodies are insulated and electrified, we say that an electrostatic force is acting between them. This force manifests itself in attractions, repulsions and stresses in the bodies and space or medium without. So great may be the strain exerted in the air, or whatever separates the two conducting bodies, that it may break down, and we observe sparks or bundles of light or streamers, as they are called. These streamers form abundantly when the force through the air is rapidly varying. I will illustrate this action of electrostatic force in a novel experiment in which I will employ the induction coil before referred to. The coil is contained in a trough filled with oil, and placed under the table. The two ends of the secondary wire pass through the two thick columns of hard rubber, which protrude to some height above the table. It is necessary to insulate the ends or terminals of the secondary heavily with hard rubber, because even dry wood is by far too poor an insulator for these currents of enormous potential differences. On one of the terminals of the coil I have placed a large sphere of sheet brass, which is connected to a larger insulated brass plate, in order to enable me to perform the experiments under conditions, which, as you will see, are more suitable for this experiment. I now set the coil to work and approach the free terminal with a metallic object held in my hand, this simply to avoid burns. As I approach the metallic object to a distance of eight or ten inches, a torrent of furious sparks breaks forth from the end of the secondary wire, which passes through the rubber column. The sparks cease when the metal in my hand touches the wire. My arm is now traversed by a powerful electric current, vibrating at about the rate of one million times a second. All around me the electrostatic force makes itself felt, and the air molecules and particles of dust flying about are acted upon and are hammering violently against my body. So great is this agitation of the particles, that when the lights are turned out you may see streams of feeble light appear on some parts of my body. When such a streamer breaks out on any part of the body, it produces a sensation like the pricking of a needle. Were the potentials sufficiently high and the frequency of the vibration rather low, the skin would probably be ruptured under the tremendous strain, and the blood would rush out with great force in the form of a fine spray or jet so thin as to be invisible, just as oil will when placed on the positive terminal of a Holtz machine. This breaking through of the skin, though it may seem impossible at first, would perhaps occur, by reason of the tissues under the skin being incomparably better conductors. This, at least, appears plausible judging from some observations.

I can make these streams of light visible to all by touching with the metallic object one of the terminals as before, and approaching my free hand to the brass sphere, which is connected to the second terminal of the coil. As the hand is approached the air between it and the sphere, or in the immediate neighborhood, is more violently agitated and you see streams of light now break forth from my finger tips and from the whole hand (Fig. 5). Were I to approach the hand closer, powerful sparks would jump from the brass sphere to my hand, which might be injurious. The streamers offer no particular inconvenience, except that in the ends of the finger tips a burning sensation is felt. They should not be confounded with those produced by an influence machine

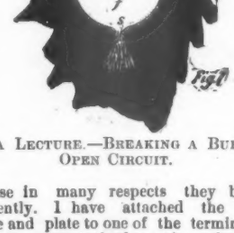


Fig. 7

TESLA LECTURE.—BREAKING A BULB ON OPEN CIRCUIT.

because in many respects they behave differently. I have attached the brass sphere and plate to one of the terminals in order to prevent the formation of visible streamers on that terminal, also in order to prevent sparks from jumping at a considerable distance. Besides, the attachment is favorable for the working of the coil.

The streams of light which you have observed issuing from my hand are due to a potential of about 200,000 volts, alternating in rather irregular intervals, something like a million times a second. A vibration of the same amplitude, but four times as fast, to maintain which over 3,000,000 volts would be required, would be more than

sufficient to envelop my body in a complete sheet of flame. But this flame would not burn me up; quite contrarily, the probability is that I would not be injured in the least. Yet a hundreth part of that energy, otherwise directed, would be amply sufficient to kill a person.

The amount of energy which may thus be passed into the body of a person depends on the frequency and potential of the currents, and by making both of these very great, a vast amount of energy may be passed into the body without causing any discomfort, except perhaps, in the arm, which is traversed by a true conduction current. The reason why no pain in the body is felt, and no injurious effect noted, is that everywhere, if a current be imagined to flow through the body, the direction of its flow would be at right angles to the surface; hence the body of the experimenter offers an enormous section to the current, and the density is very small, with the exception of the arm perhaps, where the density may be considerable. But if only a small fraction of that energy would be applied in such a way that a current would traverse the body in the same manner as a low frequency current, a shock would be received which might be fatal. A direct or low frequency alternating current is fatal, I think, principally because its distribution through the body is not uniform, as it must divide itself in minute streamlets of great density, whereby some organs are vitally injured. That such a process occurs I have not the least doubt, though no evidence might apparently exist, or be found upon examination. The surest to injure and destroy life is a continuous current, but the most painful is an alternating current of very low frequency. The expression of these views, which are the result of long continued experiment and observation, both with steady and varying currents, is elicited by the interest which is at present taken in this subject, and by the manifestly erroneous ideas which are daily propounded in journals on this subject.

I may illustrate an effect of the electrostatic force by another striking experiment, but before, I must call your attention to one or two facts. I have said before, that when the medium between two oppositely electrified bodies is strained beyond a certain limit it gives way and, stated in popular language, the opposite electric charges unite and neutralize each other. This breaking down of the medium occurs principally when the force acting between the bodies is steady, or varies at a moderate rate. Were the variation sufficiently rapid, such a destructive break would not occur, no matter how great the force, for all the energy would be spent in radiation, convection and mechanical and chemical action. Thus the *spark* length, or greatest distance through which a *spark* will jump between the electrified bodies is the smaller, the greater the variation or time rate of change. But this rule may be taken to be true only in a general way, when comparing rates which are widely different.

I will show you by an experiment the difference in the effect produced by a rapidly varying and a steady or moderately varying force. I have here two large circular brass plates *p p* (Fig. 6*a* and Fig. 6*b*), supported on movable insulating stands on the table, connected to the ends of the secondary of a similar coil as the one used before. I place the plates 10 or 12 inches apart and set the coil to work. You see the whole space between the plates, nearly two cubic feet, filled with uniform light, Fig. 6*a*. This light is due to the streamers you have seen in the first experiment, which are now much more intense. I have already pointed out the importance of these streamers in commercial apparatus and their still greater importance in some purely scientific investigations. Often they are too weak to be visible, but they always exist, consuming energy and modifying the action of the apparatus. When intense, as they are at present, they produce ozone in great quantity, and also, as Professor Crookes has pointed out, nitrous acid. So quick is the chemical action, that if a coil such as this one is worked for a very long time it will make the atmosphere of a small room unbearable, for the eyes and throat are attacked. But when moderately produced the streamers refresh the atmosphere wonderfully, like a thunderstorm, and exercise unquestionably a beneficial effect.

In this experiment the force acting between the plates changes in intensity and direction at a very rapid rate. I will now make the rate of change per unit much smaller. This I effect by rendering the discharges through the primary of the induction coil less frequent, and also by diminishing the rapidity of the vibration in the secondary. The former result is conveniently secured by lowering the electromotive force over the air gap in the primary circuit, the latter by approaching the two brass plates to a distance of about three or four inches. When the coil is set to work you see no streamers or light between the plates, yet the medium between them is under a tremendous strain. I still further augment the strain by raising the electromotive force in the primary circuit, and soon you see the air give way and the hall is illuminated by a shower of brilliant and noisy sparks, 6*b*. These sparks could be produced also with unvarying force; they have been for many years a familiar phenomenon, though they were usually obtained from entirely different apparatus. In describing these two phenomena so radically different in appearance, I have advisedly spoken of a "force" acting between the plates. It would be in accordance with accepted views to say, that there was an "alternating electromotive force" acting between the plates. This term is quite proper and applicable in all cases where there is evidence of at least a possibility of an essential inter-dependence of the electric state of the plates, or electric action in their neighborhood. But if the plates were removed to an infinite distance, or if at a finite distance, there is no probability or necessity whatever for such dependence. I prefer to use the term "electrostatic force," and to say that such a force is acting around each plate or electrified insulated body in general. There is an inconvenience in using this expression as the term incidentally means a steady electric condition; but a proper nomenclature will eventually settle this difficulty.

I now return to the experiment to which I have already alluded, and with which I desire to illustrate a striking effect produced by a rapidly varying electrostatic force. I attach to the end of the wire, *l* (Fig. 7), which is in connection with one of the terminals of the secondary of the induction coil, an exhausted bulb *b*. This bulb contains a thin carbon filament *f*, which is fastened to a platinum wire *w*, sealed in the glass and leading outside of the bulb, where it connects to the wire *l*. The bulb may be exhausted to any degree attainable with ordinary apparatus. Just a moment before, you have witnessed the breaking down of the air between the charged brass plates. You know that a plate of glass, or any other insulating material, would break down in like manner. Had I, therefore, a metallic coating attached to the outside of the bulb, or placed near the same, and were this coating connected to the other terminal of the coil, you would be prepared to see the glass give way if the strain were sufficiently increased. Even were the coating not connected to the other terminal, but to an insulated plate, still, if you have followed recent developments, you would naturally expect a rupture of the glass.

But it will certainly surprise you to note that under the action of the varying electrostatic force, the glass gives way when all other bodies are removed from the bulb. In fact, all the surrounding bodies we perceive might be removed to an infinite distance without affecting the result in the slightest. When the coil is set to work, the glass is invariably broken through at the seal, or other narrow channel, and the vacuum is quickly impaired. Such a damaging break would not occur with a steady force, even if the same were many times greater. The break is due to the agitation of the molecules of the gas within the bulb, and outside of the same. This agitation, which is generally most violent in the narrow pointed channel near the seal, causes a heating and rupture of the glass. This rupture would, however, not occur, not even with a varying force, if the medium filling the inside of the bulb and that surrounding it were perfectly homogeneous. The break occurs much quicker if the top of the bulb is drawn out into a fine fibre. In bulbs used with these coils such narrow pointed channels must therefore be avoided.

(To be continued.)

PERSONAL.

Chas. E. Dustin, the energetic head and front of the Schuyler Electric Company, Middletown, Conn., was among the distinguished electrical visitors in New York last week.

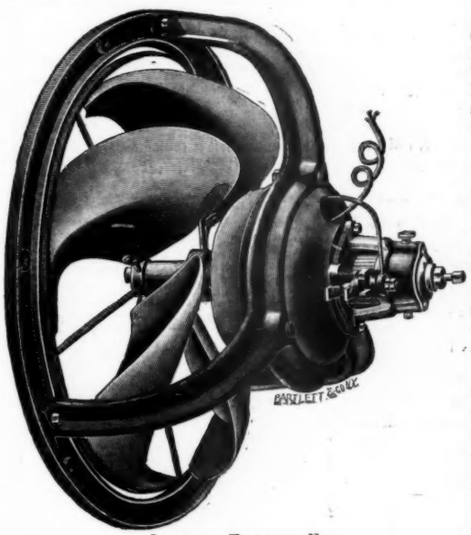
Mr. James W. Nagle, formerly of the Philadelphia *Inquirer*, will hereafter be identified with *Business*, an enterprising and successful publication, now entering its fourteenth volume. Mr. Nagle is a successful advertising manager and will be an active addition to the staff of *Business*.

Mr. George B. Lauder has been appointed inspector of electric light and power equipments by the New Hampshire Board of Underwriters. Mr. Lauder is a graduate of the Massachusetts Institute of Technology, and has had an extended experience in light and power plants, which will enhance his value in his new position.

Mr. H. E. Hawley, of Albany, general manager of the Hudson River Telephone Company, was a visitor to the metropolis last week, looking into the newest things in telephone circles and ordering new material for his company. The Hudson River Company is meeting with a gratifying increase in business and is abreast of the times in the matter of modern apparatus and management.

The Lundell Exhaust Fan Outfit.

We herewith illustrate a new outfit, which is a combination of an ordinary exhaust fan directly coupled to a slow speed Lundell motor. The absence of belting and the absolute noiselessness of the outfit are particularly noticeable. An exposition of the adaptability of this outfit for certain places is found in the installation in the restaurant of Busse & Simoni, Delmonico's old place in New street. Guests sitting directly underneath the fan do not notice that it is running. The location of the fan is novel and serves a double purpose. It exhausts the air from



LUNDELL EXHAUST FAN.

both kitchen and restaurant and gives comfort to both guests and chefs. This ventilating outfit is adapted for all places and is a sure means of keeping the air in a pure and wholesome condition. The Lundell exhaust fan outfit is placed on the market by the Interior Conduit & Insulation Company.

The Westinghouse Electric Company's Proposed Works at Brinton, Pa.

The plans for the Westinghouse Electric Company's new plant at Brinton are nearly ready. Of the 222 acres owned by the company, 23 will be covered by the works. The machine shop will cover a space of 750 feet by 250 feet; the warehouse 750 feet by 25 feet; the foundry 700 feet by 250 feet; and the boiler house 150 feet by 40 feet. Including other buildings, the area of the ground floors will be 7⅗ acres, and including the second floors, 15 acres. The structure will be fire-proof stone and steel on the latest methods, and labor-saving devices will be employed to the fullest extent. Electricity as a motive power for labor-saving machinery will be utilized. It is estimated that the saving from the consolidation of the plants will not be less than $250,000 a year. Two hundred houses for the employés will be built at once.

Changes in Train Service on West Shore R. R.

The new time table, taking effect on May 25, shows many changes in the passenger train service. Several new local trains have been added between New York and Haverstraw and Newburgh, some of which are "express locals." The only changes in express trains are on trains Nos. 1 and 2. Train No. 1 now leaves New York, Franklin street station, at 10 A. M., Forty-second street 10.10 A. M., daily, arriving at Buffalo 13.15 A. M., Suspension Bridge 1.10 A. M. Train No. 2 now leaves Suspension Bridge at 7.15 A. M., Buffalo at 8.20 A. M., and arrives in New York, Forty-second street, 8.40 P. M., Franklin street, 8.55 P. M., daily. The through train service has been greatly improved by the inauguration of new sleeping car lines from New York and Boston to Chicago, and *vice versa*, on all express trains *via* the New York, Chicago and St. Louis Railway ("nickel plate").

TELEPHONE CHAT.

The telephone line to Burlington, Wis., is being extended to Norway and Dover.

It is expected that a telephone line will soon be built from Townshend to Wardsboro and Jamaica, Vt.

The Norwich, R. I., Board of Trade demands better telegraph and telephone service and more electric light.

Work will soon commence on the new telephone line between Ellsworth, Me., and Shady Nook. The line will be of great convenience to the cottagers there.

The New England Telegraph and Telephone Company is running a line on its own poles between Portland and Bangor, Me., and the construction crew has reached Augusta.

There is a movement on foot at Abbeville, La., to organize a telephone company to connect Abbeville and the surrounding towns by wire, extending the lines as far as Lake Charles. The leading business men are at the head of it and no doubt will push it to success.

On June 6, in the United States district court in this city, a preliminary injunction was granted by Judge Lacombe to the American Bell Telephone Company, restraining J. J. Pembroke and others from manufacturing telephone apparatus embraced in the Bell patent. The injunction was returnable June 9.

The telephone has lately been arranged for use of divers. A sheet of copper is used in place of one of the glasses in the helmet, and to this a telephone is fixed so that the diver, when at the bottom of the sea, has only to slightly turn his head in order to report what he sees, or receive instructions from above.

Greeley, Colo., is to have a local telephone service, 13 of the necessary 25 subscribers having been obtained. The automatic system will be adopted, and this town will be the first west of the Missouri river to use the system, which runs without a central office or a telephone girl. Howard T. Vaille, of Denver, is managing this for the Colorado Telephone Company.

A year ago the city authorities of Lancaster, Pa., had a dispute with the Pennsylvania Telephone Company about the latter placing a pole on one of the main streets. The city had the pole cut down. In falling the wires were dragged down and Charles McGrann, a boy who was passing, was struck by the wires and badly hurt. Last week the boy's father sued the city for $10,000 damages.

The Missouri, Kansas and Texas Railway Company will, at an early date, commence the construction of a telephone line from St. Louis to Parsons, Kan., a distance of 348 miles. The wires will be strung along the Missouri, Kansas and Eastern telegraph poles from St. Louis to Boonville, and along the Missouri, Kansas and Texas poles from Boonville to Parsons. The construction of the line is to reduce to a minimum the immense telegraph tolls, occasioned by general offices in three States.

The North Carolina railway commission, which under a new law is given control of the telephone companies, has given General Manager D. J. Carson and other officers of the Southern Bell Telephone Company in Raleigh, N. C., a hearing as to the matter of rates. This marks a new departure. The company has heretofore, it is said, denied the right of the commission to regulate rates. The Western Union Telegraph Company two years ago took the same stand and threatened to quit the State, but the Postal Company at once came forward and offered to take all the lines and operate them.

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Indictments seem to be the electrical order of the day in Pittsburgh.

The REVIEW is constantly in receipt of inquiries for primary battery fan outfits. Who's got the best?

These are pretty hard times, but we notice that the conquest of the electric trolley over the raw boned horse and spavined mule goes gayly on. Humanity endorses this.

The *Morning Advertiser*, Col. John A. Cockerill, editor, celebrated its second year of existence Thursday of last week. It has reason to be proud of its record. None of the old dailies of this great metropolis is more widely quoted, and the snappy, pointed and timely editorial utterances which have characterized the *Advertiser* have given it a peculiar and growing strength. It has attracted readers of the best class, and if continued in its present course, will win a metropolitan success of which every New Yorker will be proud, and one highly gratifying to its editor and promoters.

Mr. Cawley, chief editor of *Industries*, is about to retire from the position which he has held since our contemporary was started, some seven years ago. At that time it was thought by many that the needs of technical readers were generally well met by older journals, but in spite of this view, and of the usual difficulties connected with the early life of nearly all journalistic ventures, Mr. Cawley has succeeded in piloting *Industries* to an established position in the field of technical journalism. At the beginning of this year a change occurred in the proprietary of our contemporary, and this, we understand, led to Mr. Cawley tendering his resignation. After concluding his editorial work, he intends carrying on business as consulting engineer, and has taken offices at 29 Great George street, Westminster, S.W.

Every World's Fair visitor will be welcome at the ELECTRICAL REVIEW headquarters, in the building devoted to Electricity. Up one flight, in the northwest gallery, you will find the place. You will find a chair to rest in, a book to read, and a record whereon to leave your autograph. Music has also been provided—just opposite. Mr. M. J. Bulkley will be in charge, assisted by two or three editors from the East from time to time.

The long distance telephone people have received a substantial dividend. It required great faith in the possibilities of the telephone as well as immense capital to bring this remarkable enterprise to its present successful position. We hope the dividends will continue regular and ample.

INTENSE HEATING BY ELECTRICITY.

Messrs. La Grange and Hoho, of Belgium, whose process described in our last issue for heating metals to a white heat by the passage of a strong current through an acidified solution, have suggested by their discovery the possibility of numerous applications of the result of their combined observations; and it is probable that in a very short while we will hear of new inventions based upon this heating process.

It is not altogether an unexplored field, that of heating by electricity, but the simple manner in which this localizing of the heat is accomplished makes experimenting in this particular direction enticing and interesting.

Come, inventors, get to work and let us see what you can bring forth!

ANOTHER MAGNETIC SPRING.

News comes from Pierre, S. D., of a wonderful well, a government possession in which, at a depth of 1,125 feet, a flow of 400 gallons of water per minute was struck. The remarkable part of the account is that "the water possesses the same qualities as the water of the Hot Springs in the Black Hills, being at a temperature of 92°, and is highly magnetic."

Highly magnetic? Ah! we see, it will attract numbers of our invalids who, no doubt, will feel that the "electrical properties" of this spring will cure their aches and pains.

And then again the hotel proprietors who will be drawn to the spot by the allurements of the prospect of a future gain will construct traps, and using the magnetic quality of the spring as a bait, will attract the dollars from the pockets of the gullible. Westward, Ho, for the Magnetic Springs!

INCANDESCENT LAMPS.

The incandescent lamp situation continues to interest all of us.

It is quite evident that there can be no monopoly of this product.

The Edison interests, now owned by the General Electric Company, made an able fight for the patent rights of Mr. Edison, and the highest courts pronounced their client the true inventor.

Then came the Goebel claims, strongly presented as a defense in cases where the victors were attempting to enforce their legal rights, and a halt was suddenly called in the triumphant shutting down of lamp factories not operating under the Edison patents.

The Columbia lamp interests, St. Louis, were the victors in this instance, and their glory has been great. The case is yet to come up on final hearing, and both sides express confidence in the result.

Meanwhile, non-infringing lamps are being manufactured without apparent hindrance, and two strong companies, the Westinghouse and Mather, are supplying these lamps in quantities.

Another lamp is announced. It hails from Boston, where Yankee ingenuity is ever entrenched, and may be expected on the market before another fortnight.

Two Ohio companies, the Packard and the Buckeye, had not been reached by the General Electric when the injunction at St. Louis was refused, and these companies are manufacturing up to the limit of their factories. The decision in the St. Louis case will naturally be of interest to them.

LETTERS FROM A LABORATORY.—XLIX.

BY JULIAN A. MOSES.

Not long ago I read a very interesting essay written by Arthur Helps upon the subject, "The Art of Leaving Off." In it he gives accounts of incidents where, had the person referred to left off that which he was doing at the proper moment, he would have achieved success instead of failure. But it is not advisable for an experimenter to observe this too closely. If he is in love with his work, which he should be, he ought to acquire the art of not leaving off; for it must be but a poor enthusiast who will pay attention to the minutes as they pass.

Evidently the man who declared that "a watched pot never boils" must have had to do some disagreeable work.

Recently a young man was brought by his father to Mr. Edison with the request that the inventor give the son a motto to which he could refer throughout his life, and which he could use as a guide to success.

"Young man," said Mr. Edison, "never watch the clock." Thus aptly and strikingly was given this good piece of advice.

The recipient has not been heard from yet; but if he follows that line of action in his experimental work he is sure to accomplish something. In the other occupations of life the clock is a most useful accessory to the achievement of success, and he who disregards its continually proffered assistance need never expect to become much of a business man. Knowing when to stop when other duties call is most valuable. But, if a line of work is commenced with a definite object in view, it would at first appear evident that when the objective point is either gained or missed there the work should stop. Not so. Many of the most useful and wonderful scientific attainments have been the result of an accidental discovery, and not the end of a preconceived plan. It is in the very nature of things that those which astonish us and cause expressions of admiration are those which are most unlikely to happen in the ordinary course of events. He, then, who is on the lookout for the unexpected will be most likely to recognize it and use it to his advantage when it does come. In knowing when to stop we possess a dangerous knowledge. It were better that we lose ourselves in the maze of uncertainty than be satisfied with the knowledge of those things which do exist.

The recent achievements of the two Belgian scientists who claim to have raised iron bars to a white heat by immersion into acidulated water while passing a heavy current, thus making the iron the hydrogen generating pole, while a large vessel of lead forms the other pole, and the thin layer of hydrogen adhering to the surface of the iron producing the resistance and consequent heating effects, have caused quite a stir in electrical circles. On all sides we hear remarks similar to the following: "Why, that is not new; I have produced an arc under water, and have raised the carbons to the temperature of melting iron." So much the more credit then do these investigators deserve, for they have but gone a little ahead of the others who have been satisfied with their achievements in this direction and knew or thought they knew when to stop. Another inventor declares that he had seen the very apparatus which they use; but he adds that it is a device, a patented one too, which is used for recutting files by electricity, and which makes use of the same principle, that of the resistance caused by the adhering hydrogen. But these remarks are of no avail, it is the inventor and investigator who goes but a little ahead of what others are doing or have done, who achieves success, fame and fortune.

It is the experimenter who pursues a direct line of work, and who is fortunate enough not to be affected by the many petty annoyances which constantly beset him, who will enjoy his work the most. Some inventors are so absorbed in their undertakings that everything other than what they are engaged in is thrown aside, and they become buried in their work. One well-known and intense experimenter has predicted his death in a most peculiar way; saying that if he were to discover accidentally the solution of the problem which he is seeking by easy stages, he sincerely believes that the sudden joy would kill him. This is indeed enthusiasm, but is of an unhealthy and hurtful kind.

CORRESPONDENCE.

OUR CANADIAN LETTER.

Montreal Electric Club.—The twelfth and last summer meeting, until September, of the above club took place last evening in the rooms of the Montreal Chess Club. A paper on the "Testing of Dynamos and Motors" was read by Mr. H. Ritchie. The treasurer read his report, which was satisfactory and showed a balance on hand. The officers of the club are: W. B. Shaw, Montreal Electric Company, president; J. A. Farlinger, Royal Electric Company, vice-president; Jas. Burnett, Royal Electric Company, secretary-treasurer. There are 36 names on the roll from different electrical establishments in the city.

The Montreal Electric Company.—The Montreal Electric Company is a new aspirant for public patronage in the electric construction and supply line, being composed of Mr. John Shaw (late office manager for Messrs. J. & C. Hodgson), who assumes the general management and who is one of the best known men in the Montreal hardware circles; Mr. Wm. B. Shaw, whose name will be familar to many of our readers, and who is deservedly popular with the electrical trade for his connection with T. W. Ness and the Royal Electric Co., is electrician for the firm; whilst Mr. Walter F. Taylor, the present able foreman for T. W. Ness, becomes mechanical superintendent for the new company. With such a trio of hard and experienced workers there is no fear of the success which, with many friends, we heartily wish them, in their new undertaking.—*Canadian Electrical News.*

Montreal, June 8. J. A. C.

OUR BOSTON LETTER.

The W. S. Hill Electric Company have perfected their new fan motor, and are now prepared to fill orders promptly. The motor has several new features, and from the simplicity of its construction and the business-like manner in which it does its work, will doubtless meet with a ready sale.

Dr. George L. Austin, who for many years has been a prominent figure in electrical circles, died very suddenly from pneumonia last week. Dr. Austin has long been connected with the electrical press, and possessed many brilliant qualities and a kindly disposition, which made him a host of friends.

Incandescent Lamps.—While matters have been rather quiet in the incandescent lighting field, so far as new developments are concerned, during the past few weeks, it does not signify by any means that the interest has abated, or that the situation will remain for any length of time unchanged. Matters of considerable importance are being quietly manipulated, and the trade may expect an eye-opener in the near future.

The Present Financial Situation is being felt in electrical circles here as well as elsewhere throughout the country, and the stringency in the money market has somewhat delayed progress, particularly in the field of new construction, which promised to be greater this year than ever before. While this is freely acknowledged, the general sentiment seems to be one of hopefulness, and that as soon as matters settle down somewhat, work will be pushed ahead with renewed vigor.

The American Electric Heating Corporation, of 294 Purchase street, are now thoroughly equipped and prepared to bring their many specialties in the field of electric heating prominently before the public. The New England Electric Heating Company, of 629 Atlantic avenue, are the manufacturing and selling agents for this section under the patents of the parent company, and will have the exclusive handling of the business in the East. A comprehensive catalogue is now on the press, and will shortly be ready for distribution, which will furnish illustrations and full descriptions of the many styles of special apparatus, and prove exceedingly interesting reading, from the fact that it opens up an entirely new field and one which will prove a revelation to the majority of its readers. H. G. T.

Boston, June 10.

WORLD'S FAIR NEWS.

The Intramural Railroad, which runs within Jackson Park, gave an excursion to the inhabitants of Midway Plaisance Wednesday of this week, and it is doubtful if the road will ever carry as interesting a group as on the day named. Among the company were two bands, which left a stream of melody coiled around the Fair and attracted the attention of visitors all along the line, and to the unsophisticated visitors from foreign lands it was the first experience on an elevated electric road, and it tickled them immensely. They hung over the side of the cars in open-mouthed wonder, and in jargons of many fair countries caused much commotion in an effort to express their delight at the sights along the route. It was very evident that the Midway inhabitants were delighted with the trip. The extensive grins on the dusky faces showed plainly their happiness. The party made two trips over the road, and a photograph of the throng were taken at each end of the line, after which the party was returned to the Midway and wandered to their quarters in the street.

The Formal Opening of Electricity Building, which occurred Thursday night, June 1, was a grand success, and those who witnessed it were well repaid for their efforts to gain admission to the building, as they saw the beauties of electric illuminations, never before equalled in this or any other country. For the first time since the Exposition was opened all the things, which have been hastily installed in this grand palace were displayed and Chief Barrett, sitting in the balcony looking over the display before him, declared, "Electricity has shown its greatest light and power here ever reached since the world began." It was announced that the ceremonies were to begin at 7.30 in the evening. Thousands of people were entering the building as early as 6 o'clock in order to secure good positions to witness the grand spectacle. At the hour of opening the galleries were crowded, while the main floor was completely filled with the surging mass of humanity, and it is estimated that at least 8,000 people viewed the grand column when the draperies were removed. While the Edison column was the principal attraction, all the other exhibits throughout the building were visited by those in attendance, and were seen at their best. Some excitement was caused during the evening by a fire which was discovered in the pavilion of the Weston Electrical Instrument Company. Although some of the draperies and the office desk were burned, the damage was slight, owing to the prompt action of Mr. A. P. Eckert, who turned on the water, while Mr. H. T. Paiste, as pipeman, succeeded in drenching several spectators in his zealous efforts to bring the stream to play upon the blaze, which he finally succeeded in doing, and soon had the fire under control.

To-day the Princess will make her first visit to the Fair. Mayor Harrison will do the honors, and the Chicago Hussars will be her escort. The party will be met at Midway Plaisance gateway by Presidents Palmer and Higinbotham and other officers of the Exposition. Captain Rice, with an escort of Columbian guards, will be in attendance and the corps of cadets of the Michigan military academy will form a guard of honor. She will be driven to the Administration Building and will then be tendered a breakfast at noon by President Palmer.

A reception will be tendered the Infanta by the Board of Lady Managers at 2 o'clock in the Woman's Building, and at 3 o'clock a concert will be given her in Festival Hall by T. W. Palmer and Mrs. Potter Palmer. Fireworks will follow in the evening for her benefit. The pyrotechnical programme to be given in the Grand Basin in front of the peristile to-night, by James Pain & Sons, will consist of many beautiful features.

The electric illumination for to-night will be on a grand scale. The electrical fountains will be put in operation for the first time, and Electricity Building, which the Princess will visit during the evening, will be shining in all its glory. M. J. B.

Chicago, June 10.

Suit Against Hotel Proprietors.

THEY DON'T USE EDISON LAMPS.

A complaint was filed a few days ago in the United States Circuit Court, New York, by the Edison Electric Light Company and the Edison Electric Illuminating Company, of New York, against Robert Goelet, Ogden Goelet, Robert Stafford and H. P. Whittaker, as proprietors of the Imperial Hotel; Mary J. Van Doren, Hubert N. Kiusley and Gustave Baumann, as proprietors of the Holland House, and William Zinsser, owner of 15 Spruce street, to restrain them from using in their buildings any other than the Edison incandescent lamp, and to compel them to pay damages to the Edison Company for the use of the Westinghouse lamp.

The Westinghouse Company was enjoined by the United States Circuit Court of Appeals, last October, from manufacturing lamps which were stated to be an infringement of the famous patent No. 223,898. It was, however, permitted to supply power to all plants established by it previous to that time, the contracts for which had not expired. As the Edison Company cannot sue the manufacturers of the lamps in these cases, it wishes to restrain the users.

The proprietors above named are not at all uneasy over the outcome of the suits, as they are fully protected by contract with the companies supplying the lamps.

The Lamp Situation from a Canadian Point of View.

(From the Canadian Electrical News.)

The recent decision given at St. Louis in the now famous Edison lamp case will no doubt have a marked effect on the incandescent lamp interest in the United States, and, while being a decided set-back for the would-be monopoly, its effect as regards lamp users both in Canada and the United States will be decidedly beneficial. On this side of the line lamp users were beginning to feel the effect of the closing up of several factories in and about Boston and Chicago, to overcome which some of them have even gone so far as to import lamps from Germany, with what result we are yet unable to say, except that we know there was a saving in price of about 25 per cent. This saving is of great importance to a plant renewing, say, from 5,000 to 10,000 lamps a year, if the life of a lamp is, as represented, 600 to 800 hours. But now that a decision adverse to the monopoly has been given, users will be enabled to purchase again at the old figures.

What the effect of a confirming decision on this side of the line would be it would be hard to say. It seems to be the popular opinion that the patents in Canada are not worth the paper they are written upon, notwithstanding the fact that a decision given some time ago by the Assistant Commissioner against them was reversed on a rehearing before the Commissioner in Chief. This fact, however, would have little or no bearing on the case should it ever be taken into the Courts here and decided entirely on its merits, for while the Canadian patent laws are proverbially not the most strict in existence, yet to live up to them there can be no importation of other then raw materials. The question then would hinge on whether the importing of the glass bulb ready for the fusing in of the filament and the importing of filaments ready for mounting, not to say anything of the occasional bringing in of a batch of complete lamps, would constitute, in the eyes of the law, the importation of raw material only. We certainly think it would not, but the vagaries of the law are such as to make one wary of passing a positive opinion under these conditions.

That the owners of the patents did on various occasions import finished lamps and that they still continue to import both bulbs and filaments is we understand an open secret with quite a number of individuals connected in one way or another with electrical matters in Canada, but aside from all this, our opinion is that they will never press their claims here. In fact only as far back as a couple of months ago they had not succeeded in producing a 50 volt lamp that could be classed as a commercial article, for while giving full candle power to start, they in many cases dropped off fully 75 per cent in the course of 300 or 400 hours burning.

There can be no question but that the incandescent lamp is anybody's property both in Canada and the United States, and that lamp users generally owe a debt of gratitude, if nothing else, to Mr. Rhotehamel, president of the Columbia Incandescent Lamp Company, of St. Louis, for the active manner in which he pursued and carried to a successful issue a defense remarkable for its clearness and conciseness, which we feel sure he was confident would win even before the trial came off.

The Fitch Switch for Electric Railroads.

A new switch for trolley car lines has made its bow before the public, and a trial was recently given before a number of enthusiastic and admiring railroad men. It is a remarkably simple contrivance; the attraction of an iron armature connected with a cam, which moves the tongue of the rail, by an electro magnet, actuated by current from the main line, shunted through a so-called insulated rail. The test was given on a bright June day, and everything worked to perfection. Another test will be given during a rainstorm, and the inventor, Mr. C. M. Fitch, feels confident that it will be, as was the last one, a successful exposition of a principle which he judges to be correct. In an early issue we will give a full illustrated account of the Fitch switch.

An Interview with Prof. Alexander Graham Bell.

BY CLEVELAND MOFFETT, IN "M'CLURE'S MAGAZINE."

Prof. Graham Bell is not like some pedantic wise men who talk as if they believed that the end of knowledge in their particular line had been already reached. On the contrary, this distinguished inventor is convinced that the discoveries and inventions of the past will seem but trivial things when compared with those which are to come.

THE AIRSHIP OF THE NEAR FUTURE.

"I have not the shadow of a doubt"—these are his own words—"that the problem of aerial navigation will be solved within 10 years. * * * I am able to speak with more authority on this subject from the fact of being actively associated with Professor Langley, of the Smithsonian Institution, in his researches and experiments. * * * The calculations of scientific men in regard to the amount of power necessary to maintain an airship above the earth have been strangely erroneous; I may say ridiculously so. * * * Indeed, Professor Langley concludes that when the airship has once been lifted above the earth to the proper height, it will be possible to maintain it there with proportionately no greater effort than that expended by hawks and eagles in sailing about with extended wings. * * * It may be some time before the art of managing an airship is discovered, but the final result, I am convinced, will allow men to sail about in the air as easily and as safely as the birds do.

"Electricity in one form or another will doubtless be the motive power for airships, and every advance in electrical knowledge brings us one step nearer to the day when we shall fly. It would be perfectly possible to-day to direct a flying machine by means of pendant electric wires, which would transmit the necessary current without increasing the load to be borne."

The mention of electricity brought up new possibilities for future discovery, some of them so amazing as almost to pass the bounds of credibility. He said:

"Scientists are now agreed that there is no theoretical reason why the well-known principles of light should not be applied in the same way that the principles of sound have been applied in the telephone, and thus allow us to see at a distance by electricity. Of course, while the principle is the same as that applied in the telephone, it will be very much more difficult to construct such an apparatus, owing to the immensely greater rapidity with which the vibrations of light take place, as compared with the vibrations of sound. It is merely a question, however, of finding a diaphragm which will be sufficiently sensitive to receive those vibrations and produce the corresponding electrical variations."

After he had spoken of this idea for some time, Professor Bell stopped suddenly, and, with an amused twinkle in his eyes, exclaimed: "But what is to prevent one from thinking at a distance by electricity?"

Having said this, the genial Professor threw himself back and laughed heartily at the amazement his words had awakened. Was he joking? Apparently not, for he proceeded seriously to discuss one of the most astounding conceptions that ever entered an inventor's mind. Imagine two persons, a thousand or ten thousand miles apart, placed in communication electrically, in such a way, that without any spoken word, without sounding board, key, or any bodily movement, the one receives instantly the thoughts of the other.

The fundamental premise of Professor Bell's scheme is that the human brain is a kind of electrical reservoir, and that thinking is an electrical disturbance. Assuming the correctness of this view, the possibilities of setting up in one brain a disturbance corresponding to what is going on in another, would appear to depend mainly on the discovery of a suitable medium.

In his desire to bring relief to the deaf, Professor Bell has begun a series of remarkable experiments in this line. His theory is that the brains of deaf people are usually healthy, the imperfection being in the ear only, and he holds that if their brains could be excited artificially in the same way that the brains of ordinary persons are excited by the vibrations communicated through the various chambers and passages of the ears, the deaf would hear precisely as other persons do. The problem here is to discover the proper way of tickling them.

Professor Bell's experiments upon himself have been so encouraging as to dispose him to try more conclusive experiments in the same line upon persons who have lost all sense of hearing, and would doubtless be disposed to take the inevitable risk.

The Electric Heater.

READ BEFORE THE CHICAGO ELECTRIC CLUB BY THOMAS AHEARN.

The increasing interest manifested in electric heating apparatus during the past year throughout the United States and Canada is highly satisfactory and, without a full knowledge of what interesting application of heating devices may have been made in the United States, I will endeavor in this paper to outline what we have accomplished here in Canada, and more particularly in the city of Ottawa.

The ideas relating to the limited field of electric heating are fast disappearing, and the notion that an electric light or railway plant, unless operated by water-power, cannot profitably introduce electric heat, is but an instance of history repeating itself, as witness the introduction of the telephone, incandescent light, etc.

When friction is overcome, heat is produced, whether the friction be the resistance of any portion of an electric circuit or of a purely mechanical character, as, for example, the application of the ordinary car brake; the resultant equivalent in each case appears as heat, so that if one or five horse-power of electrical energy be absorbed in an electric heater the full amount is converted into heat.

A mechanical example of this conservation of force may be demonstrated by rubbing the right hand on the coat sleeve of one's left arm. If the rubbing is brisk and continued, an unpleasant heating of the hand will result; the force expended in the muscular effort of rubbing results in an exact equivalent of heating of the hand, and the coat sleeve rubbed. This result is practically analagous to the heat developed in the heating wire of an electric heater. The resistance (or friction) offered, as in the rubbing of the coat sleeve, results in developing an exact equivalent of heat.

The operation of the electric heater may also be compared to that of an incandescent lamp, in which, as is well known, good conductors of electricity are carried to the terminals of the lamp filament, the latter purposely made a poor conductor, in order that the resistance offered by the filament and overcome by the current may produce a sufficiently high degree of heat to give the desired light. Although light alone is the object sought, it is but an accompaniment of the incandescence of the filament. In the electric heater, heat alone is desired, and heat alone is present.

The size and length of the lamp filament and the wire of the heater are both determined in very much the same manner, excepting that in the case of the heater, the calculation for amount of wire does not subject the heating wire to such a degree of heat as in the case of the incandescent lamp. The size and length of wire employed in a serviceable electric heater should be such that the heat developed will not be sufficient to destroy it by oxidation of fusion. This is greatly assisted by the design and other conditions of manufacture, and in the case of my cylindrical 500 volt upright car stove, the inlet of cooler air at the bottom, and its rush through the heated cylinder, results in a vigorous circulation of air through the space to be warmed, and this displacement of hot air by cooler air constantly relieves the heater wire within the stove.

Instead of making heaters on the plan of the rheostat, I have found that for marked results, and more particularly for the air draught, it is desirable to conserve the heat within the heater up to a certain degree, above which the construction of the heater should not permit the wire to reach.

I have also concluded that iron wire is most desirable, and among many of the points in its favor is that its resistance increases with the heat. The benefit of this quality is felt when the electromotive force is increased, as frequently happens for short intervals in nearly all classes of circuits.

By the method of construction and the use of good non-conductors of heat, as insulation and packing, the heat developed in small water heaters and large water furnaces is directed to the copper water-containing vessels around which the heating wire is wound; the heat is quickly transferred from the wire to the copper vessel, which can never reach a very high degree of heat. The air draught in my other heater operates in very much the same manner as the presence of the water in the liquid heater.

It is an interesting fact that the good conductors of heat are also the good conductors of electricity, and the poor for one is also poor for the other. This conductive quality, which is common to both forms of force, is very suggestive of a close relationship, which doubtless future investigation will determine. With the good conductors, such as copper, the current may be imagined as gliding freely through the atoms of the copper; while in the case of the comparatively poorer conductor—iron—the atoms may be pictured to throw themselves, like barriers, across the track of the current, this friction (or as we electrically term it, resistance) resulting in the development of heat. The mutual convertibility of the various natural forces is evinced from the combustion of coal in a power house, the dynamo converting the energy supplied by the coal into the convenient form of electricity, which is transmitted along wires to electric heaters placed at different points in the circuit, where we again have heat as at the starting point, the heater in turn giving up its heat to the surrounding air. It is evident thus, that from electricity heat may be obtained. It is also true that from heat we can obtain electricity as in the ordinary thermo-electric pile—the application of heat to the junction of the dissimilar metals of the pile will be demonstrated by the movement of the needle of the galvanometer.

I will now proceed to a brief description of some of the electric heating installations which have been in successful operation during the past winter.

In July of last year I had erected in the car shop of our local electric railway a baker's oven eight feet square, which was built of brick in the usual way, excepting that within the oven, and set in the foundation, were placed two of my 20 ampere, 50 volt cylindrical stoves, the interior of the oven being whitened and lighted with incandescent lamps; a small window looking into the oven, and provided with three panes of plate glass, separated from each other by air spaces, being provided for the purpose of observing the process of baking, cooking, etc. The oven was also equipped with a clock and a pyrometer, which latter instrument recorded the degree of heat within the oven. The pyrometer indicating 400 degrees Fahrenheit, a neighboring baker tried a few pans of buns. The process of baking was watched with much interest, and from the puffing up of the dough to the pretty brown finish could be seen through the window of the oven which, as before stated, is provided with incandescent lamps. A short time after, a full dinner of one of our leading hotels was cooked, including a 21 pound roast of beef, several turkeys, ducks, lamb, etc. This electric dinner was served to the regular guests of the hotel, together with a distinguished company of invited guests. The cooking of the meats was pronounced perfect, and the time occupied in cooking was 30 minutes less than is usually required to do the same work in the hotel range.

It may be interesting to state that this oven has been in full blast since it was started, and the current has been applied constantly night and day without trouble of any kind, and it is now used in drying out repaired electrical parts of railway equipment.

At the Central Canada Fair, held in this city in September of last year, a baker's oven the same as described was erected in the main building, attended by a staff of bakers. The oven was provided on one side with a window, through which our delighted ruralists gazed in wonder. The oven proved the great card of the show, and the presence of a special policeman was required to keep the crowd moving. The baker started in selling a small bag of buns at five cents on the first day, but the law of demand justified him in increasing the price to 25 cents on the last day of the exhibition, when the supply was not sufficient, although 14 pans were turned out every 14 minutes. In the same building the Women's Christian Temperance Union Dining Hall was made somewhat more attractive than in former years by the use of large electric water heaters, which supplied a dozen smaller heaters placed conveniently, and in which were made tea and coffee. The outfit was kept in continuous operation during the Fair, and although hard pressed by the crowds present, the supply was ample; no other means of heating water was employed. The success of this display will be best appreciated by the fact that the financial results were for the first time in many years of a satisfactory nature.

An ordinary hot water radiator connected by pipe with an electric furnace placed in a pit below the floor, lighted by incandescent lamps and covered with an iron grating flush with the floor, attracted the attention of householders. The absence of a chimney and other accessories of a hot water coal furnace, added to the fact that the closing of a switch only was necessary to obtain heat, which might be continued indefinitely without dirt, dust or labor, were doubtless the main reasons for the innumerable inquiries made as to the cost of operation, etc.

As no long continued test of this form of hot water house heating had ever been made, I concluded that only two installations of this description should be made during the winter just passed.

The first installation was made for the purpose of heating a gentleman's conservatory in this city. The furnace was placed in the basement, the controlling switches on the floor above, and all connected with the 50-volt lighting circuit. The total amount of pipe employed in the conservatory was 300 feet, the current absorbed being equal to three horse-power. The amount charged by the light company was based upon the cost of an equal amount of power from motor circuit. The operation of this plant has been a great success, having worked continuously and absolutely without attention since October last, the user being so much pleased with its success that the question of heating the entire premises electrically is now under consideration.

The second installation of the hot water system was made in R. A. McCormick's drug store, Sparks street, this city. The premises was piped throughout for hot water heating in November of last year, the electric furnace being placed in the basement. This 50 volt furnace was constructed in five independent heaters radially connected to a common supply pipe, each heater being independent of its neighbor, the five sections both mechanically and electrically being connected in multiple. Each of the sections was controlled by five 10 ampere switches, which were placed in a row in the store above, so that for all conditions of weather the heat could be regulated by turning off and on any of the five sections into which the furnace was divided. Another important consideration which suggested this design was that in the event of trouble with any one of the five sections comprising the complete furnace, it could be detached by closing the valves, and the particular section which might require examination could be removed without disturbing the other four-fifths. Despite the fact that the past winter was unusually severe in this usually cold climate, this outfit worked without a hitch and without attention of any kind, and provided at all times the heat desired.

For the usual Christmas display of the Chaudiere Electric Light Company, I designed an electric upright boiler which operated a one horse-power engine, both the engine and the boiler being placed upon a large table in the company's office. The boiler was provided with steam gauge water glass, safety valve, etc. Being nickel plated throughout, it presented a very handsome appearance. The safety valve was set for 35 pounds pressure, which operated the engine. As heretofore steam engines have been employed in applying the power necessary to energize dynamos, the novelty of this outfit consisted in the fact that the electricity was developed by water power, which was converted into heat, making steam in the boiler, and which was then used in driving the steam engine.

The charge that is here made for current used in the numerous one gallon water heaters, which have been largely introduced by the Chaudiere Electric Light Company, is based upon the amount charged for the 16 candle-power lamp, which is $8 per annum (the user paying for lamp renewals). Motor rates are charged for larger installations. These water heaters are used in barber shops, drug stores, bar-rooms, etc., and absorb three times as much current as one 16 candle-power lamp—3×8=$24. The company collects 50 cents per week for the current supplied each heater, making $26 per annum, as against $24 if the same current was used for lighting. The charge is considered small by the users, and the service is very satisfactory.

The business done here during the past year in electric heating devices of various kinds has amounted to a very respectable sum, and will here, as it should elsewhere, increase from year to year.

Telephone Strike Ended.

The strike of telephone linemen in Brooklyn and New Jersey has ended in victory for the New York and New Jersey Telephone Company. The company refused to raise the scale of wages to $3 per day, as demanded by the men, and after letting matters drag along for three or four weeks the men decided to try to get back at the former per diem of $2.50.

The difficulties in the New Jersey division were adjusted last week with the aid of the State Board of Arbitration, which counseled the 75 strikers to return to work at wages ranging from $2 to $2 50. The job of putting the telephone wires underground in Newark and Jersey City will be pushed through the summer months, and the officials hope to have it finished by the end of August. Already half the connections in Newark have been changed to underground.

"We filled all our orders last month," remarked General Manager Sargent, to a reporter, "and the strike has affected our regular business little, if any. Construction of new lines has been delayed somewhat, as a matter of course, but the company is not seriously embarrassed thereby. In New Jersey, for instance, the strike put back the construction of a new line between Freehold and Long Branch, for use in the summer months, but our facilities are equal to those of last year, and we have not lost anything." Mr. Sargent stated that most of the men in the New Jersey division have returned, and that construction will go on about as usual, for the remainder of the year.

ELECTRIC RAILWAY AND POWER NOTES.

Crawfordsville, Ill., will have an electric street car line.

The electric line to Chickies Park from Columbia, Pa., is expected to be in running order by July 1.

The people of Fairbury, Ill., are ready to pay over their subscription to the electric road as soon as the power house is built at that place.

Franklin, Pa., is talking electric railway. Oil City will have one by July 1. Warren will also have her's going by the middle of the summer.

Lowell and Lawrence, Mass., are to be connected by an electric railway. Capitalists have taken hold of the matter and will push the work.

Citizens of Hanover, Mass., are moving, with every prospect of success, to form a company to build an electric road from North Hanover to connect with the road in Rockland.

Representatives of the stockholders of the Traction Company, of Ashland, Pa., met last week, when it was decided to increase the capital stock of the company from $600,000 to $1,000,000 and the mortgage indebtedness from $300,000 to $500,000.

It is announced that the landowners along the line of the projected Indianapolis and Martinsville, Ind., Electric Railway will be asked to take stock in the company. The civil engineer who has been making the survey of the route estimates that the road will cost $35,000 per mile.

Roanoke, Va., continues to develop. The city has now in operation 15 miles of electric street railway, and by June 25 will have 21 miles. A new power house under construction will cost $15,000, and when completed the outlay by the street railway company for the last 12 months will exceed $200,000.

The West Broadway electric car line, of Louisville, Ky., was last week opened for business. The line runs from First and Water streets to Market to Second to Broadway to Twenty-eighth. It will furnish transfer service between the Tenth street Union station and the Seventh street Union station.

Negotiations are not altogether off between the Youngstown Street Railway Company and the village of Girard, O., respecting a line of electric road to the latter place. The council has submitted two propositions under which a franchise will be granted. First, a 25 year franchise; the fare to be 10 cents to all points on the company's line for the first three years and five cents thereafter. The second proposition is based on a five cent fare to the Diamond, in Youngstown.

Grading on the Sandusky, Milan and Huron Electric Railway is now in progress on the south hill at Norwalk, O., and track laying, which has been completed over the river bridge, is progressing at a rapid rate and it is expected that all the rails will be laid between Sandusky and Norwalk within a week or two. It has been the intention of the construction company to have the line in operation by the first of July and present indications are that their purpose will be accomplished.

The Central Indiana Electric Railway Company has been organized at Noblesville, Ind., with a capital of $4,500,000, the purpose being to construct and operate a double rack electric road from Indianapolis to Noblesville, from which point single tracks will be built to LaPorte, *via* Frankfort; to Logansport and Peru, *via* Kokomo; to Marion and Fort Wayne, *via* Elwood, and to Muncie, *via* Anderson. The road will be equipped for both freight and passenger traffic with the very best appliances. The incorporators are men with means at their command and experience in public enterprises, and includes capitalists from London, Philadelphia, Chicago and other points.

The "Acme" Portable Testing Set.

The rapid and correct measurement of resistance under varying circumstances is an important factor in electrical engineering, and for this purpose it is highly essential to use apparatus that properly meets the requirements of every day practical work.

The "Acme" portable testing set herewith illustrated and described, embodies the result of long experience on the part of Queen & Company, of Philadelphia, in manufacturing such goods, and will be recognized as even more complete, compact and convenient than their previous sets which have met with much favor wherever used.

It comprises a Wheatstone bridge, rheostat, D'Arsonval galvanometer, "aluminum-iodine" battery and double contact key, all contained in a handsome mahogany case of outside dimensions, 8¼x5¾x5 inches, and weighing less than six pounds complete. The leather case illustrated (Fig. 1) is very convenient when the apparatus is used by inspecting engineers, as it can be slung over the shoulder and carried as readily as a small hand-bag.

The coils in both bridge and rheostat are wound with the celebrated platinoid wire, and adjustments are made with great care, an accuracy of one-fifth of one per cent. being guaranteed. The arrangement is similar to the "post office" design, with three coils in each bridge arm and 16 coils in the rheostat, giving a total range by means of the reversing attachment of from .001 ohm to 11,110,000 ohms.

The galvanometer is a modified form of the D'Arsonval type, made specially for the purpose, and is strongly built, hence not liable to injury, and is perfectly dead-beat, so that readings can be taken very rapidly. Magnetic fields and mechanical vibrations produce no effect whatever, and the instrument will give as accurate indications in the street, on shipboard or in a dynamo room, as in a college laboratory.

The battery is of the new "aluminum-iodine" form with electromotive force of $1\frac{1}{10}$ volts per cell, or equivalent to a total of 17 volts; this is said to be practically 50 per cent. more than the ordinary chloride of silver cells. Should the battery be exhausted from long use, it can readily be removed from the box and renewed at slight expense.

The apparatus complete is shown in Fig. 1, while Figs. 2 and 3 indicate the arrangement of working parts. In Fig. 2, A and B represent the two proportional bridge arms, R is the adjustable rheostat, and X the unknown resistance or line. In Fig. 3, the arm A, of Fig. 2, is equivalent to the coils 1, 10, 100 on the left hand center row, and the arm B to the coils 10, 100, 1,000 on the right hand of the same row. The rheostat R corresponds to the coils of the top and bottom rows, aggregating 11,110 ohms, and X, the unknown quantity, is connected between the top binding posts at the lower left hand corner.

In Fig. 3 the blocks marked A, R, B and X are connected to the bridge arms, and are the same as shown in the center of Fig. 2. They constitute the "reversing arrangement," whereby the bridge arms may be interchanged and six coils be made to do the work of eight. Thus, when one plug is placed between A and R and another between X and B, the order of the arms working clockwise and beginning with R will be: R : X :: B : A. If the plugs are changed so as to connect A to X and R to B, the order will be: R : X :: A : B. By this means it also becomes possible to readily detect inaccuracies in the bridge ratios should any exist, and to eliminate them entirely in work. Thus, if the two 100 ohm coils of the proportional arms are slightly different, this fact becomes evident in practice by reversing and balancing them. If with a given unknown resistance the resistance in the rheostat has a different value in one case than in the other, the two bridge coils must be slightly different, and the correct value of the unknown will be the mean of the two rheostat resistances used in obtaining the two balances.

To use the apparatus, the terminals of the resistance to be measured should be connected to the binding posts mentioned, and an approximate estimate formed of its value. For example, suppose it is about 400 ohms, the proper method of procedure will then be as follows:

Plug A to R and X to B, and unplug the 100 ohm coil in both A and B, and also the 500 ohm coil in the rheostat. Connect one cell of battery and close the key for an instant (it is always best to start with very small battery power, as in that case no harm can be done if the unknown resistance is estimated far from its proper value). If the galvanometer needle swings to plus, the resistance unplugged in the rheostat arm is too high; if to minus it is too low. By altering the unplugged resistance of the rheostat arm and, if necessary, increasing the battery power, a "balance" can quickly be effected and thus the value of the unknown determined to within one ohm. Should the resistance be lost, for instance, 10 ohms, the same plan should be followed, except that the two 10 ohm coils of the bridge should be used instead of the 100 ohm coil. If the resistance be higher than the total resistance of the rheostat, for example, 800,000 ohms, plug A to X and B to R, and unplug 10 in A and 1,000 in B; the proportion will then be as 1 is to 100, and a balance will be obtained when 8,000 ohms is unplugged in the rheostat.

Fig. 1.—View of Complete "Acme" Testing Set, Queen & Company, Philadelphia.

From the preceding description it will be evident that the apparatus is remarkably simple in operation, so that an inexperienced lineman can learn to use it in a short time. The great value of such an instrument will be evident to those who have used the forms heretofore obtainable, which usually necessitates the handling of two boxes, one for the rheostat, galvanometer and bridge, and a separate one for the battery.

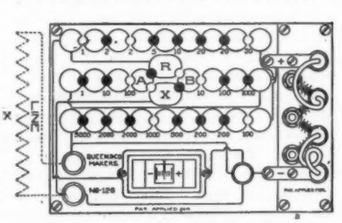

Fig. 2—Diagram of "Acme" Testing Set.

The manufacturers, Queen & Company, incorporated, Philadelphia, are anticipating a very large demand, and have arranged to turn out the sets in sufficient quantity to fill all orders promptly. They will be pleased to furnish further particulars upon application, as also to forward descriptive circular No. 445, to interested parties.

How to Increase Speed in Ocean Steamers.

As to the possibility of adopting other fuels than coal, there can be no doubt that for the purpose of getting a ship across the Atlantic at the quickest speed, there is, at least, one fuel that would attain this purpose better than coal. The burning of petroleum in boilers has long since passed beyond the experimental stage as an engineer's question. The cost of this fuel has prevented its adoption as a steam-producing agent everywhere except in the oil-producing regions. It is stated that the supplies are so limited that it is impracticable to adopt oil for ships, as the enormous quantities that would be required would soon make prices prohibitive. Experiments on an extensive scale have shown that one ton of oil will do as much work as two tons of the best coal. Here then, we have a means of saving one-half of the weight of fuel to be carried. The weight saved can be utilized to give a knot and a half more speed. The question of adopting oil for the purpose of obtaining increased speed in trans-Atlantic travel is one which cannot fail to be interesting to Americans. If the greatest attainable speed is of national importance, and that attainment is only possible by the use of oil fuel, the nation possessing the control of oil supplies can, other things being equal, have the fastest ships as long as oil maintains its superiority as a fuel. The supply of oil to these ships at a commercially practicable rate would have to be insured. This might only be practicable by preventing its use for other purposes of less importance nationally. But there are other difficulties which have first to be overcome before oil as a fuel for fast passenger steamships can be generally adopted, not the least of which is the accustoming of passengers to the idea that an oil-fuel ship is as safe as a coal-fuel one. The engineering difficulties are not great, and a much more conveniently worked ship could be designed if oil fuel were adopted.—*Professor Biles in North American Review for June.*

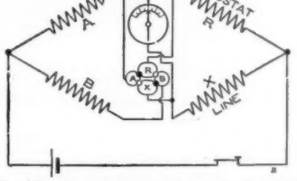

Fig. 3.—Diagram of "Acme" Testing Set.

Long Distance Telephony.

Reporter (in telephone box).—Hello! Connect me with the *Sun*.

Old Lady (who is standing behind him).—Dear me! How perfect they must have those long distance telephones nowadays!—*Town Topics.*

ELECTRIC LIGHT FLASHES.

Pulaski, N.Y., is putting in electric lights.

An electric light plant is being installed at Suero, Tex.

Northfield, Vt., is experiencing a revival over the subject of electric street lighting.

Eau Claire, Wis., has let a contract for electric light for five years at $75 per lamp.

Branchville, N. J., will have electric lights, the dynamos being driven by water power.

The boiler capacity at the Narragansett, R. I., electric light station is to be increased 1,000 horse-power.

Preparations are being made to set the new boiler and engines for the electric light plant at Homestead, Pa.

Boston will have to put her electric wires underground before 1900. Really, now, this should be ample time, even in Philadelphia.

The citizens of Dowogiac, Mich., will vote this month on the question of purchasing the plant of a local electric light company for $16,000.

The Phœnix, Ariz., Electric Light and Power Company are about to enter upon the construction of a large addition to their works south of the city.

The Rockland, Thomaston and Camden Electric Railway Company has taken the contract for lighting the State prison and the streets of Thomaston, Me., with electricity.

Work at the New Blanchardville, Mass., electric light plant is now progressing rapidly. The dam will soon be finished, and it is perhaps not too much to expect to see the station in operation by July 1.

Plans are being drawn, it is said, for additional buildings on the marsh at the Lynn River works of the Thomson-Houston Electric Company. If the present ideas are carried out, a building will be erected which shall be over 500 feet in length and 300 feet wide. The building will be of wood, and will be used as a blacksmith shop and for the punching department.

The improvements at the Benwood plant of the Wheeling, W. Va., Steel and Iron Company, in the way of a new electric light plant and appliances, are going forward rapidly. During the past week a majority of the foundations for the different machines have been laid. The building which will contain the new plant is being enlarged by a new addition of brick on the south end

The Indianapolis Light and Power Company has nearly completed what it claims is the largest smokestack in the State and one of the largest in the country. With the laying of a few more bricks it will be 150 feet high. It has a diameter of 20 feet at the base and a 10-foot diameter, inside measurement, from bottom to top. It is octagonal in its shape, and required in its construction 500,000 bricks.

The people of Whitesboro, N.Y., want that village lighted by electricity. The taxpayers have voted favorably on the question, but aside from this little if anything has been done. Some of the citizens favor including in the tax levy the sum of $2,000 for the purpose, and then making the most advantageous terms possible. In this way the money would be raised and time would be given to decide whether it would be best to erect a plant or make a contract with companies that are anxious to furnish the village with light.

In accordance with the notice given a few weeks ago the Babylon, N. Y., Electric Light Company has cut off the current from the arc lamps that have heretofore illuminated the streets of Babylon. The lamps were supported by subscriptions from adjacent property owners, and the company say the collections were so little that the lights had been run at considerable loss. A meeting of the Town Board will be held shortly, at which it will be attempted to form a lighting district and tax it for the street lighting. In the meantime the village is in darkness.

A Special Carbon Exhibit.

The Hardtmuth carbon exhibit in the Electricity Building, World's Fair, is attracting wide-spread attention. Messrs. Hardtmuth & Company, of Vienna, evidently appreciate the increasing demand for high grade carbons in the United States, and have, in connection with their American representatives, the International Thomson-Houston Company, made a very elaborate and creditable exhibit. Both solid and cored carbons are shown, varying in diameter from one-eighth of an inch to 12 inches. European experience has demonstrated to the satisfaction of the manufacturers that arc lamps run in multiple arc are in every way preferable to the series system. The almost insurmountable obstacle in promoting multiple arc lighting in this country has been the fact

HARDTMUTH CARBONS, WORLD'S FAIR.

that American carbon manufacturers have thus far failed to produce a carbon sufficiently soft and fine for use in low potential arc lamps. Notwithstanding the very greatly increased cost of these carbons over American carbons, Messrs. Hardtmuth & Company have already succeeded in securing a large amount of business. We are informed that Messrs. Hardtmuth & Company have the largest carbon manufacturing plant in the world, and that they control over two-thirds of the entire business in Europe.

Mr. Moriz von Hardtmuth is here in person looking after the interests of his company. He states that this company has lately made a very valuable discovery in the manufacture of carbons, whereby the efficiency of Hardtmuth carbons has increased over 30 per cent., and at the same time giving an increased light of 25 per cent. over the old style carbons. With this advantage and a reduced price they hope to secure a much larger share of the American business.

The World's Columbian Exposition has purchased 100,000 of these carbons for exclusive use in arc lamps running on incandescent and motor circuits, conclusive tests having shown them superior to any other carbons submitted.

Telephonemeter is the new word naming an instrument to register the time of each conversation at the telephone from the time of ringing up the exchange to the ringing off signal. Such a system would reduce rentals of telephones to a scale according to the service, instead of a fixed charge to a business firm or occasional user alike. The instrument has been constructed at the invitation of the German Government Telephone Department, and is to control the duration of telephone conversations and to total the time.

Automatic Safety Switch and Rheostat.

The rapid increase in the number of stationary motors used on railway and power circuits has led to a demand for satisfactory automatic switch for the protection of the motor. It frequently happens on circuits where the load is variable, that the circuit is opened at the station by the circuit breakers. The circuit is always closed, as soon as possible, and unless the rheostat or main switch of the motor has meanwhile been opened, the current is turned on to the motor when no resistance is in its armature circuit. In such a case a very large current flows through the armature and does damage by blowing fuses, flashing around the commutator, and in many cases burning out the armature.

For the protection of motors under such circumstances, the General Electric Company has devised an automatic safety switch and rheostat, which takes the place of the ordinary double pole switch and starting rheostat, and acts as an automatic circuit breaker to protect the motor from injury by any abnormal condition of load or power supply.

The rheostat proper consists of resistance wire wound upon spools of incombustible material, which are fastened to the back of switch base. The latter is supported by the iron box, which encloses the spools. On the front of the switch base are mounted the switch contacts, the switch arm, and the automatic releasing mechanism.

NEW AUTOMATIC SWITCH AND RHEOSTAT.

The switch is made up of two segments of a metal ring, to which the line wires are connected, two sets of resistance points arranged on arcs of a circle, just outside of and concentric with the line rings, and a switch arm, carrying a brush at each end, which makes connection between the line rings and the resistance points on the same side of the switch arm. A spiral spring tends to return the switch arm to the *off* position, and it can be left in the *on* position only when the motor is running under normal conditions. When the arm is in the *off* position, both sides of the line are open, and no current can enter the motor.

Two electro-magnets govern the automatic action of the switch. One of these, known as the detent magnet, is connected in series with the field coils of the motor, and governs a detent pin, which holds the switch arm in the *on* position after starting the motor, so long as the field current is maintained in the magnet. The other magnet, called the relay magnet, is in the main circuit, and controls an armature which, when attracted, short circuits the detent magnet.

In case the circuit is opened for an appreciable length of time the current in the detent magnet ceases, and the switch arm being released flies round to the *off* position.

If the field circuit of the motor is broken, the switch arm is released, and the motor is shut down.

The switch also acts automatically to shut down the motor in case of a dangerous overload. The armature of the relay magnet is so adjusted that when the current increases beyond the safe load of the motor, it is shut down by short circuiting the detent magnet.

By connecting push buttons to wires running from the patent magnet, the motor may be shut down from any desired part of the building. This is a very valuable feature, and it furnishes a means of stopping the machinery promptly in case of accident.

It will easily be seen from the foregoing that the automatic safety switch and rheostat furnishes complete protection for the motor and makes it practically impossible to injure it by carelessness of the operator, accidents to the line or to the driven machinery, or by purposely overloading it.

True Bills Returned by the Pittsburgh Grand Jury in the Blue Print Case.

Latest reports from Pittsburgh in the case of the disappearance of the now celebrated blue prints state that the Grand Jury have found true bills against C. A. Coffin, President of the General Electric Company, W. J. Clark, Milton H. Hamilton, E. W. Rice, W. H. Knight, Morris W. Mead, Superintendent of the Pittsburgh Bureau of Electricity, charged with conspiracy, and C. E. Christian, John Butler and Frank Carey, charged with conspiracy and larceny by the officials of the Westinghouse Electric Company. There are some interesting developments predicted when these cases are tried.

Governor Pattison, at Harrisburgh, last Saturday, granted requisition papers for Messrs. Clark and Hamilton (non-residents), because it was shown that they were in the State at the time of the alleged offense. Requisitions were refused against other officials of the General Electric Company.

LITERARY.

We have received with the compliments of the author "Municipal Ownership—Its Fallacy," by M. J. Francisco, of Rutland, Vt. The author points out the dangers of municipal ownership and presents a number of valuable comparisons secured from cities in all parts of the United States. The fact is disclosed that in nearly every case the cost per hour for lighting is less when contracted for with a private company than when furnished by the municipality. The work contains a number of interesting and valuable figures, which will make it a desirable addition to every electrical library.

Wall Street and the Electrical Stock Market.

The market closed decidedly stronger to-day than on any previous weekly period for two months. Values, while very low, showed pronounced tendencies toward higher prices. The movement is based upon a rapidly growing confidence, both at home and abroad, coincident upon President Cleveland's official announcement that there will be held an extra session of Congress in September with a view of repealing the Sherman silver law. The first signs of outside buying caused the bears to start towards cover. The result was that much of the advance to-day was caused by their transactions. The liquidation still goes on in the financial and business world. It is at its height at Chicago and about over in New York. Perhaps the most potent cause of the better feeling is the weakness of sterling exchange and in consequence a cessation of the gold export. During the past seven days a pronounced exporting grain movement has started in. This makes promise of continuance, and will undoubtedly serve as a lever to turn the balance of trade in favor of the United States.

The market of next week will depend very largely upon the growth of favorable conditions and will probably have an upward tendency. We do not believe that the long looked for bull market has arrived, as conditions are not yet sufficiently pronounced. It is probable that an advance of five points in the industrials, and possibly the active granger stocks will take place, which will be followed by a reaction.

General Electric, while not as active as during previous periods under review, was, nevertheless, one of the centers of attraction. During the early days of the week it is believed that a considerable portion of the short interest was covered. This was substantiated by a falling off in the loan rate. Stocks rallied during this movement. Afterwards the bears again sold it down below 70. The rally to-day was to 73⅞. Our Boston advices are to the effect that large blocks of New York stock have found their way to Boston during the decline, being purchased by capitalists of the latter city. Much of this was secured below 75. Large stockholders of the company have made up their mind not to give the stock a speculative support, but will buy it on every soft spot in the market. One of the news agencies on yesterday made a statement, which it claims to be semi-official, to the effect that the dividend would be reduced to six per cent. per annum from 8 per cent., the first reduction to be made in the quarterly dividend of ½ per cent. to 1½ per cent., payable in August.

Western Union was a favored object for the bear attacks. The lowest price of the week was 80¼ on Monday, the highest 84⅝, the closing of to-day. The advance of a point and a half on to-day's sales was largely upon short covering. Several lots of the collateral trust five bonds sold at 103 to 104.

Edison Electric Illuminating did not show much strength, although there was comparatively little stock offered for sale. The lowest price was 104¾ on Monday, the highest 106, which ruled yesterday. Inasmuch as the bonds sold at 110½, and are convertible into stock par for par, it can readily be seen that the stock quotation is a speculative one.

North American showed a little strength to-day, closing at 9⅛ against 8¼ the opening of the week. Mr. Henry Clews informs a representative of the ELECTRICAL REVIEW that the work of soliciting proxies to be used in the interest of shareholders at the annual meeting this month, continues with satisfactory success. He says, however, that if the Villard management will put up three men satisfactory to the proxy committee, that the latter body will cease its labors. The other side informed me that there will be no change in the management.

Of the less active stocks American District Telegraph closed at 51½; American Telegraph and Cable at 83½; Central and South American Telegraph was offered at 115; Commercial Cable was bid 100 against 125 bid last week; Mexican Telegraph was offered at 200, and Northwestern Telegraph bid 104½.

In Boston, Bell Telephone sold down to 192 after reaching 193 on Tuesday, but a limited number of shares were traded in. The quotations of Erie Telephone were 84 to 85, which showed about the range for the week. New England Telephone closed at 58, a gain of 2 points. Fort Wayne Electric was quoted at 8¼ bid and 9¼ asked. Westinghouse was bid 25¾ and held at 27.

The copper market is very weak and dull. The nominal quotation for lake is 11 cents. The exports during the week were very heavy. They consisted of 1,158,074 pounds of matte, valued at $51,473, against 845,869 pounds, valued at $36,900 last week, and 2,061,753 pounds of fine copper, valued at $219,509, against 500,575 pounds, valued at $47,300, last week.

General Electric has declared a semi-annual dividend of 3½ per cent. on the preferred stock, payable July 1 to holders of record June 19.

New York, June 10.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Electric Railways.

ST. JOSEPH, MICH.—Stephen A. Douglas, Jr., Col. L. L. Stephenson and J. F. Keyser, all of Chicago, are engineering a project to build an electric railway along the St. Joseph river from St. Joseph to South Bend.

BRIDGETON, N. J.—Bridgeton and Port Morris will soon be connected by an electric railway.

GLENS FALLS, N. Y.—The directors of the Glens Falls, Fort Edward and Sandy Hill Street Railway Company have voted to increase the capital stock from $120,000 to $150,000.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company announces that it will expend $500,000 in the equipment of its lines within the next four months.

CAMDEN, N. J.—The Camden Horse Railroad Company (electric) has contracted for $50,000 worth of steel rails and proposes laying ten miles of new track.

HANOVER, MASS.—Capitalists who are interested in a movement to build an electric railroad from Assinippi to Rockland, have organized the Hanover Street Railway Company. Among those interested are Frank Alger, Herman L. Curtis and William F. Turner, of Assinippi; Nathan O. Oakman and Jedediah Dwelley, of North Hanover.

POTTSTOWN, PA.—The Chester County Electric Railway Company has been incorporated by Eli S. Root, William S. Mauger, Samuel S. Halteman and David Tittlow. The company will build an electric line from Douglasville to Pottstown and Parkerford, with branches to West Chester and Pughtown.

WACO, TEX.—The Waco Street Railway and Electric Light Company has increased its capital stock $50,000 for improvements to its plants.

HAVERHILL, MASS.—The Haverhill and Groveland and Merrimac Valley railway companies have gone out of existence, and the Lawrence, Lowell and Haverhill street railways have taken possession, merged in the divisions.

NORRISTOWN, PA.—The Chestnut Hill and Norristown Passenger Railway Company, recently chartered to construct an electric railway between Philadelphia and Norristown, has accepted the franchise granted by the town council on May 16.

HARTFORD, CONN.—The Hartford Suburban Railway Company; capital stock, $50,000; incorporators, Linus B. Plimpton, C. M. Henney, P. H. Quinn, W. E. Goodwin and David Henney. The company is authorized to purchase or lease any horse or electric railway running from points outside the city of Hartford.

SAN BERNARDINO, CAL. — The Southern California Manufacturing Company, whose principal place of business is to be at Pomona, has been incorporated by John H. Dale, John E. Packard, C. E. White, James H. Todd and H. P. Wilkinson. Capital stock $50,000. The company will furnish electric light and power to Redlands and San Bernardino.

HARTFORD, CONN.—The cities and boroughs committee of the legislature has reported favorably on charters for the following proposed electric lines: The Port Chester and Glenville Tramway Company, to build in the town of Greenwich. The Enfield and Somers Tramway Company, to build from Thompsonville to Somers. The Stonington Borough Street Railway Company, to build a short line in that borough. The Mystic Street Railway Company, to build from Mystic to Stonington. The Windsor and Suffield Tramway Company is to build between those towns.

PHILADELPHIA, PA.—The Southern Railway Company; capital, $50,000, has been incorporated by Ellwood Becker, Jno. Virdin and John Plaison.

TYRONE, PA.—The Tyrone Electric Street Railway Company, length, 15 miles; capital, $300,000. Promoters, G. W. Burket, S. B. Templeton and James Pritcherdy.

NEW ORLEANS, LA.—The directors of the St. Charles Railway Company contemplate issuing $1,000,000 for electrical equipment.

W. S. HILL ROTATING FAN MOTOR.

POTTSVILLE, PA.—The stockholders of the Schuylkill Traction Company have voted to increase the capital from $600,000 to $1,000,000, and the mortgaged indebtedness from $300,000 to $600,000.

ALLENTOWN, PA. — The Allentown and Lehigh Valley Traction Company has been incorporated with a capital of $1,250,000. M. L. Kuffman is interested.

MARION, IND.—A company has been formed for the purpose of constructing an electric railroad from Marion to Hartford City and points in Wells County. Marion and Cincinnati capitalists are interested.

BETHLEHEM, PA.—The Bethlehem and Catasauqua Traction Company has been granted a franchise by the Town Council, with the proviso that the tracks shall be first completed from Catasauqua to Bethlehem before ground is broken here.

COLUMBUS, GA.—The North Highlands Electric Railroad Company will erect a large power house on the banks of the Chattahoochee River.

Electric Light and Power.

NORWICH, N. Y.—The Norwich Light Company; capital stock, $50,000. Incorporators, Stephen C. Medbury, Harry J. Donaldson and Herbert C. Westcott, of Ballston Spa, and L. W. Emerson, of Warrensburgh. The company will manufacture and supply gas and electricity for light, heat and power.

PAW PAW, MICH.—The proposition to bond the town for the purpose of putting in an electric light plant was carried by a vote of 168 to 51.

SPRINGFIELD, O.—The great agricultural implement factory proprietors of the city are investigating electricity as a motive power for running their factories.

WAYNE, PA.—The Citizens' Electric Light Company has been incorporated with a capital stock of $5,000.

MOUNT PLEASANT, UTAH.—The Mount Pleasant Electric Light Company; capital stock, $10,000; incorporators, L. J. Jordan, W. B. Glandland, William Zabriskie and Olif Erickson.

CALIFORNIA, PA.—An electric light company will be formed here by local capitalists.

BUTTE CITY, MONT.—A number of capitalists of Butte City are planning to utilize the water power of the Big Hole River for operating machinery to generate electricity for all purposes in the city. The estimated cost of the plant is $1,000,000.

LUDLOW, KY.—The city clerk will shortly issue an advertisement for proposals for lighting Ludlow by electricity.

New Manufacturing Companies.

TRENTON, N. J.—The Trenton Electrical Construction Company; capital, $25,000. Incorporators, George F. Applegate, Carl F. Adams, Paul Suplee, Jeremiah P. Toman and Anton Adams. Its object is to manufacture, operate and sell all kinds of electrical apparatus for lighting and for power purposes, and for acquiring and dealing in patents and franchises.

CLEVELAND, OHIO.—The Cleveland Surgical and Electrical Instrument Company; capital, $25,000. Incorporators, John R. McQuigg, Joel W. Monroe, Albert C. Langell and John Colahan.

CHICAGO, ILL.—The Higgins Gravity Motor and Electric Gravity Clock Company; capital, $1,000,000. Incorporators, George C. Higgins, Samuel L. Smith and Joel J. Squier.

CHICAGO, ILL.—The City Electrical Company; capital, $100,000. Incorporators, Martin Bergman, Philip B. Schaffer and Joseph Kastner.

New Telephone Companies.

SYRACUSE, N. Y.—The Syracuse Telephone Company, not yet incorporated, has applied to common council for a franchise to do a telephone business.

ABBEVILLE, LA.—A movement is on foot to organize a telephone company to connect Abbeville and the surrounding towns.

EAST HAMPTON, L. I.—The East Side Telephone Company has been incorporated with a capital of $500, by J. Edward Huntting, Benjamin J. Van Scoy, Jos. S. Osborne and Samuel S. Conklin. The lines will run through the towns of East Hampton, Southampton and other places.

CHESTER, S. C.—The Chester Telephone Company has been incorporated by A. W. Love, J. K. Henry, S. M. Jones and C. W. Carpenter.

The New W. S. Hill Rotating Fan Motor.

The illustration herewith is an excellent representation of the new rotating fan motor which has just been put on the market by the W. S. Hill Electric Company, of Boston, Mass. As will be seen at a glance the motor is of an entirely new design, and the rotation is obtained in a remarkably simple way from the current of air generated by the fan itself. The crescent shaped rudder against which the air is driven can be set at any angle, and the speed of the revolutions governed thereby, or by being set so as to offer no resistance the motor can be made to remain stationary.

The simplicity of construction is another strong point in its favor, as there is absolutely nothing to get out of order, and the motor can be run continuously for an entire season without requiring any attention whatever. It is perfectly noiseless, self-lubricating, and weighs complete about 20 pounds. The fan is 12 inches in diameter and runs at 1,500 revolutions per minute on a 110 volt circuit, requiring less than one ampere of current to operate it.

The advantages of rotating motors have been thoroughly demonstrated, and experience has led to a combination of all the best features in this latest production, with the additional advantage of being able to run the same machine either as a rotating or stationary motor at will.

The well known reputation of the W. S. Hill Company is sufficient guarantee for the excellence of the workmanship, and the motor has given splendid results wherever so far introduced.

The Tice-Lintner Potential Indicator.

The improved form of the Tice-Lintner potential indicator, as recently placed upon the market, is shown in the accompanying illustration, and while not differing materially from the original instrument contains several improvements that go to make it a most perfect indicator. The advantages accruing from close potential regulation are so obvious that it is unnecessary to dwell at length upon them. Repeated tests with high efficiency lamps have been made with this instrument resulting in every instance in increasing the life claimed for the same. The Tice-Lintner potential indicator combines with a volt-meter of the highest degree of accuracy, permanency and dead beat qualities, an alarm attachment of equal reliability, which immediately attracts the attention of the attendant to any change or variation in pressure, and the same is remedied before any damage ensues to the lamps or motors on the working circuits. Aside from the alarm the especial features of the instrument are the entire lack of permanent magnets, or any other deteriorating element, and the fact that it can be operated in the close vicinity of intense magnetic fields without disturbing the accuracy of its readings. A neat circular is now being issued containing a full and complete description of the instrument and all interested in prolonging the life and efficiency of their lamps should send for one to the Tice-Lintner Electric Company, Minneapolis, Minn.

KINDRED INTERESTS

Mr. Chas. Ludlow Livingston, of 121 Forest avenue, Pittsburgh, announces that he is prepared to contract for the complete equipment of electric street railways, central stations, isolated plants, etc. Special attention will be given to wiring of fine residences and business blocks.

The Berlin Iron Bridge Company, of East Berlin, Conn., will build a new machine shop for the Fuller Iron Works, at Providence, R. I. The peculiarity of this shop will be that the sides are entirely of glass, under the patents lately granted the Berlin Company for this construction. The building will be 90 feet in width and 210 feet in length.

The Iowa Electric and Construction Company, of Des Moines, Ia., is highly complimented in the *Mail and Times* of that city, issue of May 20. The company has established well located offices and warerooms, and should receive a large patronage. The officers are: President, E. C. Spinney; vice-president, E. G. Pratt; secretary, J. A. Innes; treasurer, William Bowen.

The Electrical Engineering and Supply Company, St. Paul, Minn., are the Northwest agents for the Packard incandescent lamp. This lamp is well known to the readers of the ELECTRICAL REVIEW as possessing high efficiency, and is fully guaranteed. The St. Paul company is reported to be doing a large business with these lamps, and besides has an extensive trade in general electrical supplies.

Queen & Company, Incorporated, Philadelphia, have a new specialty in the "Acme" portable testing set, described elsewhere in these columns, which can hardly fail to meet with great favor. It is remarkably compact and complete, all necessary parts, including battery, being contained in one small and handsomely finished mahogany case that weighs only six pounds. The set is particularly well adapted to outside testing, but gives equally accurate results in central stations or factories, and on shipboard. It will be extensively handled by the trade as a standard article.

W. R. Ostrander & Company, of 204 Fulton street, have issued the ninth edition of their catalogue. It has been carefully revised, and contains copious illustrations and descriptions of their many electrical and other specialties. Their new bell alarm speaking tube mouth piece is an ingenious and welcome accessory to the old-fashioned speaking tube; for the musical tinkle of the bell is much more pleasant to the ear than the harsh screech of the whistle. A large assortment of bell-hanger's hardware gives ample opportunity for a satisfactory selection of appliances for either large or small installations.

The Central Electric Company, Chicago, are getting in large consignments of Okonite, and are filling their orders promptly. The sales of Okonite for the last month have been enormous, and the factory has had more than it could do to keep up with the demand. By increasing its facilities, adding new machinery and working overtime, they have been able to get abreast of the demand, and promise to take care of orders promptly. The company also report having a run on fan motors. The Lundell motor, made by the Interior Conduit and Insulation Company, New York, which the Central handles, is recognized as one of the most compact, noiseless and proper machines for keeping cool, and a big stock is carried, customers being supplied promptly.

The National Pipe Bending Company, of New Haven, Conn., manufacturers of the national feed water heater, have just supplied a new 1,200 horse-power feed water heater to the electric light company at Asbury Park, N. J., to replace one of 600 horse-power in use only one year. They are also building a 1,000 horse-power for the electric plant at Duluth, Minn., and are supplying two heaters for the new plant at Northampton, Mass., and another of 200 horse-power for the Quincy plant at Massachusetts, and an 800 horse-power supplementary for the North Shore Traction Company.

The Railway Equipment Company, Chicago, reports contracts made for type "G" overhead material during the last few weeks with Tiffin, O., Electric Railway Co.; Belle City Street Railway Co., Racine, Wis.; Norristown, Pa., Electric Railway Co.; South Chicago City Railway Co.; Mobile, Ala., Electric Light and Power Co.; Camden and Atlantic Railroad Co., Atlantic City and Camden; Calumet Electric Street Railway Co., Chicago; Trenton, N. J., Iron Co.; Columbia and Ironville, Pa., Street Railway Co.; Lehigh Traction Co., Hazleton, Pa.; Wheeling, W. Va., Railway Co.; Wichita, Kan., Electric Railway Co.; Fox River Street Railway Co., Green Bay, Wis.; Pottstown, Pa., Passenger Railway Co.; Wyandotte and Detroit River Railway Co., Ecorces, Mich.; Cumberland, Md., Electric Railway; Montreal, Canada, Street Railway; Independence and Rush Park, Ia., Railway; Westminster and Vancouver Tramway Co.; Gettysburg, Pa., Electric Railway; Second Avenue Passenger Railway, Pittsburgh; Pittsburgh and West End Passenger Railway; Escanaba, Mich., Electric Street Railway Co.; Atlantic Avenue Railroad Co., Brooklyn; Hammond, Ind., Electric Railway Co.

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THE CONTROLLER OF THE CO.,
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OFFICE OF THE LIGHT-HOUSE ENGINEER,
THIRD DISTRICT,
TOMPKINSVILLE, N. Y., May 26, 1893.

Sealed proposals will be received at this office until 12 o'clock M., Thursday, the 8th day of June, 1893, for furnishing Miscellaneous Articles for the Light-House Establishment. The articles needed consist of nineteen numbered lots, embracing, respectively, Charcoal; Building Material; Engineers' Supplies; Hardware, Tools, etc.; Iron and Steel; Belting; Graphite Paints, etc.; Lumber; Plate Glass; Galvanized and Russia Sheet Iron, Tin, Solder, Sheet Zinc and Iron Wire; Sheet Brass and Copper; Composition, Brass and Nickel Castings; Bricks; Acids; Iron Castings; Sheet-Iron Smokestacks for Boilers; Electroplating Supplies; Shooks for Oil Supply Boxes, and Miscellaneous Articles; all of which are enumerated in the specifications attached to the form of bid, which may be obtained on application to this office. Samples may be seen or information obtained at this office concerning any article not sufficiently described in the specifications. Bids will be received for one or more numbered lots complete. Envelopes containing proposals should be indorsed "Proposals for Miscellaneous Articles." The right is reserved to reject any or all bids, to strike out any item or items in the specifications, and to waive any defects. The right is also reserved to require the delivery under the contract of a greater or less quantity of any item mentioned in the specifications other than quantities therein specified. Bidders are invited to be present at the opening of proposals. D. P. HEAP,
Major of Engineers, U. S. A., Engineer Third Light-House District.

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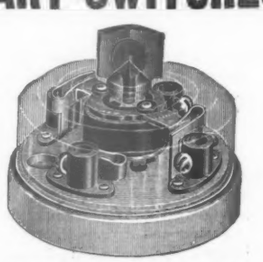

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(Extract from Preface

"The subject of exchanges has been taken up principally to round out the scope of the book; and for much of the matter under this head I am indebted to the writings of Messrs. A. S. Hibbard, F. A. Pickernell and J. J. Carty.

"In covering the ground which comes most properly under the title, the properties of telephone lines, I have endeavored, so far as possible, to avoid mathematics, and to treat the subject in a way which would prove most interesting and instructive to the general reader as well as to the student. Where it has seemed best to put in a mathematical demonstration, it has been put in a footnote.

"The results of investigations in regard to the properties of telephone lines, I have endeavored to state clearly in a general discussion. They are not susceptible of tabulation, and the most important properties it is impossible to formulate exactly.

"I have treated rather fully the questions of interference with the telephone currents from outside sources, especially the troubles from electric railways; for my practice in that direction, during the last four or five years, has been considerable, and enables me to deal with that subject in the light of personal experience. This question is still of considerable importance in this country, and its treatment here may be of assistance to managers of exchanges in practical work.

"It was my intention that the book should be one which would prove useful to the practical man, as well as that it should serve as a basis for a lecture course to students. I have therefore thought it best to introduce some matter in which correct elementary ideas of matter and energy are developed, so as to lead up to the most modern conception of the method of propagation of electro-magnetic disturbances."

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